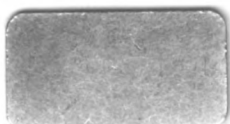




Scottish geographical magazine

Scottish Geographical Society



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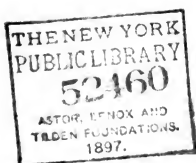
THE SCOTTISH GEOGRAPHICAL MAGAZINE



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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ANNUAL ADDRESS.

PALESTINE: THE LAND AND THE PEOPLE AS THEY ARE.

BY SIR CHARLES WARREN, G.C.M.G., F.R.S.

THERE are few amongst us who are not still interested in the dreams and fanciful imaginations of childhood, and who do not look back with pleasure to the era when so much was dim and unknown, the blanks filled up with the creations and constructions emanating from our brain. And however much we have in later life grappled with stern realities, there are few, who still keep youthful hearts, who do not cling to the romances of old, ever ready to rehearse them again and discuss them with children. The matter-of-fact details of everyday life would pall upon and weary us if we could not dress them up according to our fancy and give them a pleasant guise—if we could not turn many of our gravest trials into ridicule, and make merry over our misfortunes. It is our power of sympathy with the foibles of youth, and living again in our children and young people, that enables us to thoroughly appreciate the past.

So also with ourselves as a nation,—ever eager to look back to the wonderful old times that have passed away, of which we can so readily imagine the pleasure, and with so much difficulty realise the discomforts and difficulties. How many of us have loved to live and linger in imagination among the chivalrous Normans, the indolent and yet energetic Anglo-Saxons, the cultivated soldier-like Romans, the impetuous devotional Celts! How delightful it is to revel in those glorious old days, when all was mystery and uncertainty; to strip our thoughts of their modern garb, and discard the medium of our everyday associations;

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to people the world again with fairies and gnomes and giants and dwarfs: or, to take another line, and find ourselves among the religious rites, and pantheon, and old civilisation of the Mediterranean shores.

What a wonderful world we appear to have missed, in which every rock and every fountain—even the teeming earth—were instinct with life *divine*; when the very festivals and religious ceremonies, dances, philosophy, and music were accounted but as means for withdrawing the thoughts from human occupations and business, and turning to the love and worship of God. In those days, however much divine worship was contaminated, yet it was a pervading portion of the life of the people; whereas to-day there is too great an inclination to put it off and on as convenient, or to conceal its very existence.

So it was with the science of Geography: when Strabo and Tacitus wrote, there was still a veil over all, and every discovery was considered a step further to the great unknown; the mind of man was full of enthusiasm, and his body filled with energy to compass the difficulties to be overcome. There were great works to be done—works worthy of heroes—and men nerved themselves to the task. In those days the exact sciences were little known, and men could give full vent to their reflective faculties, and learned to think and to speculate.

Little by little, discoveries have shown that everything is more prosaic than was conjectured, and though the results were most valuable to the people of the earth from a practical point of view, yet gradually the romance has worn away—we have awakened to the stern realities of fact—and there might seem a danger of the old enthusiasm gradually evaporating as a more matter-of-fact view supervened.

But, fortunately, our natures will not admit of this. As the delightful theories of bygone days pass away, we invent new theories—our search after the unicorn and the missing-link is scarcely over, and we start up some new idea sufficient to keep us in motion. Year by year there is less to discover and less to discuss as to the marvellous; but we are still starting up questions which occupy the attention of the enthusiastic. Now we apply our knowledge to engineering purposes, to cutting canals or constructing railways, or making huge inland seas, or draining marshes.

On all these matters the science of Geography comes to our aid, with the kindred sciences—leads us to explore untrodden paths, to scale hitherto inaccessible mountains, to descend into unknown depths, to pass through the Dark Continent, until we find, on looking back, that we have, as a nation, in reality, not one whit lost the spirit of our ancestors, but are still pressing on with the same vigour after the unknown, and with the same dauntless recklessness which has always characterised our race, still filled with the romantic experiences of the past, and looking forward to a bright future. While this continues—whilst the sons of Britain will give up their comfort and luxury to take part in the voyages of enterprise and discovery so constantly going on, and to render aid to those in difficulty and danger, we can have no fear that we are declining



as a nation, and we must accord to our Geographical Societies credit for assisting in keeping up the freeborn spirit and courage and self-devotion of our race.

At this very moment are two of our most intrepid countrymen offering to risk all in order to render assistance to that gallant Austrian lieutenant of Gordon's, now shut up and surrounded in the Equatorial Provinces of Africa.

Palestine has not been so prolific a scene for adventures as many more inaccessible countries, but yet it has afforded our countrymen, and many of other European nations, opportunities for suffering privations and hardships in searching after information. And of all countries it is the one in which there is most food for speculation, the use of the imaginative faculties, and for gratifying the devotional aspiration of our race. It is not only the cradle of our own religion, but it is that of the Jew's, and in some measure of the Moslem's also. It possesses an ancient people, using the same language, and with the same manners and customs, possessed 3000 years ago. Owing to various reasons, its ruins in many parts have not been touched by man's hand for full two thousand years. There are whole towns still existing in ruins just as they were destroyed by the earthquakes in the early centuries of our era. It is therefore the country through the medium of whose people and manners and customs one has most opportunity of looking directly into the past, and living again in ancient worlds.

Palestine of to-day may, both as to its people and its monuments, be compared to a museum of antiquities gathered together from all parts and of all ages. Of some ages there are but the minutest fragments and vestiges, but yet sufficient to allow experts to allocate them their proper epochs. Palestine contains the remains of people and monuments of many kingdoms and empires now vanished for ever, or entirely changed—the Canaanites, Hittites, Egyptians, Assyrians, Phœnicians, Samaritans, Greeks, Romans, Arabians, Turks, Crusaders, modern Egyptians, and Hebrews.

Some of its people are still distinct in race, and many of the monuments are just as when originally built, save for the destructive earthquakes. I can do no more this evening than call attention to a few items of information as to the past, and say to each of you what I believe is scarcely necessary in such an institution as this.

If you want to have a lasting interest to carry you through life—one which will pervade all your works and your ways, one which will enable you to interest yourself in a great variety of subjects hitherto unthought of—take up the subject of "Palestine: its people, its history, and its geography," and give it a careful study. By doing so, you will not only understand our great Book of life more thoroughly, but will also learn lessons concerning the races of Europe, and the influence of Judaism and Christianity upon the world, which will be of lifelong advantage. I am sure you will not think that in making these remarks I am wishing to

infer that most of you do not this already, in this seat of learning of North Britain, where, of all people in our realm, you have paid such close attention to all matters connected with holy writ; but, while on the subject, I cannot withhold testimony on the advantages to be derived from this study.

Palestine is a small territory, about the size of Wales, of strange configuration, and peculiarly situated. To the east a desert, to the west a harbourless sea-shore, Palestine was the thoroughfare between the great Assyrian and Egyptian Empires, and has been termed the "battlefield of nations." And yet, owing to its mountainous character, it was shut out from other people. The Israelites were enabled to remain a secluded people, and successfully to resist the assaults of other nations so long as they were true to themselves and worked together for one common cause. Their ruin was internal dissensions—they were their own enemies.

The result of the peculiar position of Palestine is that it has become pre-eminently the "Land of Ruins" of all nations—so much so that, for miles and miles in all directions, there is scarcely a hill-top which is not covered by the remains of fort or fortress of bygone ages.

But Palestine is not only most peculiarly placed; it is also most singularly configured geographically. There you have the greatest varieties of climate. The Jordan, rising at about the level of the Mediterranean Sea, flows into the sea of Tiberias at a level of 600 feet, and into the Dead Sea, at a level of about 1400 feet, below the ocean. In journeying about the shores of the Dead Sea, you may see clouds floating far above you which you know are below the line of the ocean. No doubt this great fissure on the earth's surface was once connected with the Red Sea, and the water was level with it. When the ground rose near Akaba, the water was cut off, and, evaporating, diminished in volume, gradually exposing Lake Huleh and the Jordan Valley, Lake Tiberias, and eventually the Dead Sea—until the time arrived when the evaporation was balanced by the amount of water which poured in by the Jordan and other rivers.

Since then—that is to say throughout the historical period—the height of the Dead Sea has remained nearly the same; some years falling, and again rising a few feet, according to the rainfall in the hill country. The salt which was left in the soil has gradually been washed out in places, but in others it still remains, and prevents verdant vegetation until it is washed out by means of irrigation. It would be possible now, by means of a cutting from Tiberias, to irrigate the whole of the Jordan Valley and put it under cultivation, giving a large area for growth of grain, but this cannot be done under the present Government. Meanwhile the land lies enjoying a long Sabbath, except near the river-side on the Jordan banks, where corn has been grown since the earliest time—for certainly close on 4000 years.

Palestine can be divided physically into many portions. There are the rich loamy plains along the Mediterranean sea-shore, whose soil grows

the most splendid corn ; then the swelling hill country ; and again the mountainous districts, rising to about 3000 feet ; then a steep fall of 4500 feet into the Jordan and Dead Sea Valley ; a rise again of 4000 feet to the land of Gilead and Moab, a narrow district of hilly country ; and then the great level plain forming the desert of Arabia—desert enough in certain seasons, but in others a beautiful grass country, in which corn is grown without difficulty. To the north rise the twin mountain ranges of Libanus and Anti-Libanus, with the tall white peak of Hermon overlooking the rise of the Jordan, a country rich in fruits, and in ruins—and in remnants of ancient races.

THE RESOURCES OF PALESTINE.—It is estimated that Palestine at one time supported a population of at least ten times that which it supports at present. When one comes to view the existing ruins, it is evident that this is not over-estimated, and that the population may have been twenty times its present amount. Then the question arises, Why is it now so comparatively unfruitful and unhealthy ? The reply is most simple: A government which cares not for the people ; its only object being to screw the highest revenue it can wring from them.

The results are no roads, wagons, harbours, boats. Justice is too uncertain to allow of capital being employed in cultivation. Great carelessness has arisen as to husbandry, knowledge has departed, and a proper succession of crops is unknown. There are not sufficient people to till the land. The terraces on the hill-sides have fallen into decay, and have accumulated in the valley bottoms. The rain which once percolated into the mountain-sides now rushes down those bare slopes, and plays havoc with the vegetation below, running rapidly to the sea. Consequently the perennial fountains have ceased to flow in many cases, and in others the supply of water has been greatly reduced. This has reacted upon the atmosphere ; clouds cease to hover over the country at certain seasons, as in former days ; and, lastly, the rain has ceased to fall in proportion to the requirements of the land.

This cause and effect is not hypothetical ; it can be traced out in the minutest details. As regards Palestine, it may be fairly said that, up to a certain point, the more people it has the more it will support, always supposing a just government ; but at present the people are oppressed and wronged, there is no security of property or person, no justice, no honesty among the officials, no freedom of the press. Bribery and corruption, in our sense of the word, are mild terms to use ; and unfortunately, the maladministration commences at the top—no Pasha can afford to be honest, no Governor-General can venture to be just.

Unhappily, the days are gone by when the Moslem rulers were tolerant of creeds, and fostered the trade of Jews and Christians. During the days of Saracenic learning, both Jews and Christians were permitted full freedom of religious worship, and a certain amount of civil liberty, but Siljuk the Turk scared liberty away full eight centuries ago, and it has

not returned. It was the Turks who, by their intolerance, brought the arms of Europe to bear against them in the Crusades ; and it is the Turks who now oppress the people of Syria—not the Christians and Jews only, but also the Arab Moslem. For the Turk to the Arab is an alien and a barbarian. The Arab is, as it were, a Moslem by nature ; the Turk cannot even become a Moslem by art. If a peasant grows rich and looks fat, he finds himself put in prison and eased of his wealth—for the Pasha can only live by his extortion. Immediately the fellah begins to cultivate, he is taxed heavily, not on what he obtains as fruits of the soil, but on what he is going to obtain several years hence.

Now, as to the present condition of the country. In the plains the soil is wonderfully rich, and wells can be sunk, though at considerable depths ; the hill-sides are bare, the soil having tumbled to the bottom of the steep deep valleys, but there it lies ready for redistribution. The fountains are dry, the hill-tops are denuded of their trees, the clouds are wanting. This is not the condition of the country as the Promised Land—Moses promised them a “land of brooks,” not of dry valleys as now exist, but of pools, fountains, and running waters.

The white skeletons of the old system of tenancy still visible on the bare mountain-sides, and the roots of trees still peering from the rocky fissures, attest the fact that the hill country of Palestine was once cultivated in a satisfactory manner. The system was very simple. Walls of rough stones were built round the hill-sides, 3 to 4 feet high, according to the steepness of the slope, and the space between them and the hill filled in with fat loam ; then another wall, and another from bottom to top, until the mountain-side presented the appearance from the opposite hills of a series of steps—from the bottom it looked like a stone wall, from the top it looked in Spring like a green plateau where the trees did not hide it. Any one who has seen the terraces in France, Italy, or Spain will understand the system.

On these terraces were planted the fruit-trees—figs, vines, mulberry, apple, and others, those of a more delicate nature being planted on the northern side, so as to be less exposed to the full effect of the scorching sun's rays. These trees would thrust their roots into the rocks. The rain in falling would, instead of rushing down in torrents to the valley, lie on the terraces and percolate over to the roots of the trees, and thence into the mountain-sides, and from thence would issue again by and by as perennial streams. The water which remained in the soil about the roots of the trees enabled them to spread out their leaves in thick groves over the land, thus protecting it from the sun. The soil was therefore not burnt up and parched, but gave out moisture daily, rising above the trees, and, on reaching the higher and cooler atmosphere, was condensed into clouds, thus protecting the trees and land as it were with an umbrella.

Thus, where there is now a glaring sun, dry winds, dry earth, and absence of vegetable products, were once fleecy clouds floating through the balmy air, the heat of the sun tempered by visible and invisible

vapours, groves with moist soil, trickling streamlets issuing from the rocks, a verdant vegetation, and an abundant population—and with a good government this might be brought about again.

In spite of the government, the influx of Europeans is altering Palestine for the better, and I have seen changes take place under my own eye in the space of three years, and I can point out places where cultivation has been fostered by Societies, and where the whole climate has altered. One great result of terracing the mountain-sides is the increased amount of water in the fountains at the foot available for irrigation purposes, and the raising the water in the wells in the plains nearer to the surface. At present, a great portion of the water which rushes in torrents down the wadies forms into unhealthy lagoons along the coast, and is thus almost worse than useless.

The soil in the plains is so exceedingly rich that it still supports a great number of villages, but the ruins of others are visible in all directions. In each village there is at least one common well, with a wheel revolving night and day, worked by animals supplied by the villagers. The water is not only used for ordinary purposes, but also for irrigating the fruit-trees.

One of the great dangers to the plain is the rolling sand, blown up from the sea-shore, and advancing in mighty billows thirty to forty feet high. They have taken hundreds of years to grow to this height, and if not checked will in time engulf the richest portion of the plains. In some parts, as down near the Suez Canal, they have reached the height of several hundred feet, and have quite covered up the old Land of Goshen. Here is, then, a most extraordinary sight—a series of wells which existed in the earliest times, and which, by the labour of the inhabitants, has from time to time been kept clear of sand, until at the present time it exists at the bottom of an enormous crater of sand. In the same way, in the plain of Philistia, you may ride over miles of sandy dunes, rising and falling exactly like waves of the sea, which have been suddenly solidified, and in journeying on you come to craters in the sand with, at the bottoms, fruit-trees, then to a cottage, with its little garden—all surrounded and engulfed in sand, which the peasant, by toilsome labour day after day, keeps off his treasures. No doubt these isolated farms are but the remnants of villages which have been completely covered over, and as time goes on some of the fairest lands of Palestine will thus be lost. In parts where the winds are very violent, the tops of these sand dunes have a rapid motion, travelling several feet in a year, so that in some places I have seen telegraph posts hanging in the air suspended by the wires, while those which had been in the troughs are nearly covered over by sand.

THE PEOPLE.—Fellahin are the farming population of Palestine. They differ in race from the townspeople, and differ among themselves. There is no reason for suggesting that they are Arabs of the desert. History gives

us no warrant for supposing this. All testimony goes to show that they are the people of the country from the earliest date. What is the admixture of Hebrew, Egyptian, Babylonian, Greek, or Latin blood, we have no means of ascertaining, but we have every reason for supposing that they are the direct descendants of the hewers of wood and drawers of water who were left in the land at the time of the conquest under Joshua. Language does not serve as a certain guide, but in this instance there is a survival of the ancient names, which goes far to show that the fellahin are of the old race, with subsequent admixture; and the remnant of idolatrous worship also supports this view.

Our own insular manners and customs are in many respects of ancient date—quite two thousand years old; and therefore it should not be surprising to find in Palestine a people but little changed for at least three thousand years. Although a sturdy independent race, yet they are accustomed to bow and bend, and not to present stiff necks to the storm.

They have been credited with many bad qualities and vices: let me say that perhaps we think the worse of them because they are not ashamed of themselves—they know no better. And yet this is a matter for consideration. We are civilised and Christians, and know right from wrong, and are full of vices; they are very little worse than ourselves, and are ignorant of right and wrong. Many accusations against them fall to the ground when inquired into. It is constantly stated that they are liars pre-eminently. I cannot concede this. I believe there is no liar like the European; he never knows when to stop. The Arab lies in the most barefaced manner until a certain point; if he once speaks the truth he sticks to it, and will not vary his statement. It was this knowledge of his character which enabled me to unravel the mystery about Professor Palmer in 1882. It is a characteristic of most native tribes. I must confess that I hear fewer lies when among savage races than in Europe. Here we have the story varied in every conceivable manner; among them the story can have but few varieties—their memories are so good that they can relate what they are told word for word, so that you may have exactly the same story from a dozen sources. In Britain they would all differ. I know scores of Arabs and savages into whose hands I would venture my life. They have their code, and we have ours. An Arab will risk his life to save that of one he vouches for.

At one moment an Arab may cut your throat without compunction; a moment after, if he has given you his plight, he will save you at the risk of his own. I have employed the most unmitigated scoundrels from the most cut-throat villages in Palestine, and have found them to be as docile and harmless as any one could wish. Many a time have Sergeant Birtles and I been entirely at the mercy of two or three of our fellahin workmen—lowered down by ropes by them into deep gullies, when a slip would have lost our lives, and been accounted a mere accident. I have the utmost faith in the Arab peasant if he is taken in the right way. At the same time I will allow that he thinks nothing of

stealing behind a stranger, and despatching him with a blow on the head. An Arab will beat round the bush, and tell all manner of lies, until you drive him to the truth; when he once tells it, it is finished—he will say to all your cross-examination, “I have told you, it is finished.” He is wonderfully enduring, but he has his limits, and seems to make his mind up, before he endures, how far he will go. I heard of one man who stole and concealed a piastre (2½d.), and, after having received one hundred strokes of the bastinado, he spat the piastre out of his mouth—he had arrived at his limit. I cannot agree that they have no sense of humour—they are brimming over with humour, and are as full of chaff as a Briton. I found chaff the great lever for working among them. When I have been set upon by a village, I have always endeavoured to make one of the people look foolish before the others; as soon as this was accomplished, they would laugh at him with me, and I was safe. On one occasion I was on the top of a small hill or ruined heap, which they tried to carry by assault. I had a stick, and the first assailant had a stick, and we came to blows! The others watched. I managed to avoid showing the pain I felt when struck; but, whenever I struck my antagonist, I made a face, and jeered at him to come. He could not stand it, and looked foolish; they all laughed at him, and then crowded round me in great good humour—having come to laugh with me and become my friends. They will readily sympathise with Europeans, especially our countrymen, and very soon attach themselves to us. One has to humour their little peculiarities. They will not sell bread, and they are too poor to give it. How is one to get it from them? One has to go through a ceremony—make them a present of the value of the bread, and they will bring the bread shortly down as a present; one can trust them to do that. With them trust begets trust. After I once knew them, I made no bargains as to wages, but paid them what we considered necessary, and got their receipt. If it was a question of renting land, a receipt was absolutely necessary—otherwise they would come again next year and claim payment; but we hear sometimes of bills being sent in a second time even in Europe!

Though called Moslems, their religion is certainly derived from ancient sources. Mixed up with the Moslem creed, they have certain customs of very ancient date, which have a strong smack of the worship that obtained at the time that the Israelites entered the land.

They have their sacred places, generally on heights, which they call after some saint, known or unknown. Here is built a small square building, with domed roof—called a waly, cubbeh, or Makâm. The ground is sacred, and the trees around are sacred. A man dare not tell an untruth when on this spot; his promise made here is sacred; articles left here are, as a rule, perfectly safe. On one occasion, however, I was on a journey with a Bedouin sheikh and imaum. The Bedouin wanted corn, and we came to a Makâm, where some corn had been left. Our horses were knocked up for want of food. The imaum rehearsed an incantation,

and desecrated the ground. They took what corn they required, and then reconsecrated it, and passed on their way. They said it was an unusual action. The spirit of the sheikh inhabits the sacred spot, and blesses or curses the people—and here vows are made.

DWELLINGS.—The people are divided into two distinct classes, according as they dwell in tents or houses. The tent-dwellers, like the Israelites before entering the Promised Land, are nomads, shifting their tents from place to place, as it seems most desirable to them. The house-dwellers are, of course, fixed in position, and therefore more under control. Ibrahim Pasha, when he governed Palestine from Egypt, some forty years ago, recognised this great principle, and reduced the lawless Bedouins to immediate subjection by causing them either to live in houses or to vacate their territories. There are in the Adwān country, at the present time, the stone houses which they were forced to occupy at that time, and at which they looked with the greatest disgust and abhorrence; for not only was it disagreeable to them to live in so foreign a manner, but it also deprived them of their power to inflict injury on others, as their women and children and chattels were always to be found. The houses, about which I am now going to speak, range in magnificence from straw huts to stone mansions. They are, as a rule, flat-roofed, as in so many parts of the Mediterranean. They are in many cases constructed with a battlement or parapet wall, to prevent any one falling over it by accident (as is provided for in Deut. xxii. 8). These flat roofs are used for a variety of purposes—drying figs, raisins, and other fruits; airing the corn and flowers, talking over business matters, and sleeping. When I was in occupation of Tor in 1882, our Marine sentinel was obliged to step over the prostrate form of a slumbering archbishop, whenever he marched round on his beat. In villages, the proclamations are usually made from the housetop of the sheikh, just as occurred in early days.

These flat roofs were in most instances made of mud, resting on brush-wood, supported by joists of fir or other timber; but in towns cement is frequently used, or a kind of salt mud, beaten in diligently for many hours. In the Lebanon, earth is often used of considerable thickness, and on each roof is a roller of stone, with a moveable wooden handle, which can be taken off and transferred from one roller to another—each roof having its own roller. Immediately rain falls, these rollers are put into use so as to fill up the cracks, and prevent the water from entering the houses. The seeds from grasses and weeds wafted in the air, or brought up with the fruit and wine, take root in the roof, and quickly spring up, and as quickly wither away from want of moisture, giving rise to the saying, "As grass upon the housetop."

At Jerusalem, we read that people lived on and used the housetops for various purposes; and it has been cited as singular that at the present time the housetops are for the most part domed, and not flat. The reason

of this is very apparent. During the siege of Jerusalem by Titus, the wood for several miles around was cut down to supply the various engines of war—battering rams, etc. The country was denuded of its trees. Up to this time all the houses were flat-roofed ; but from henceforth, in rebuilding the city, a new feature was introduced into the houses. There being no wood readily obtainable, and stone being cheap and easily procured, the houses were built with stone domes, and very thick walls to support them. The result of this has been that the ruins of the various Jerusalems destroyed since the time of Titus are much more bulky than those of the Jerusalems which preceded his time. One of the proofs of the erection of stone roofs in Jerusalem in early days is the discovery, during our excavations, of a stone roller for a flat roof, exactly similar to those in use now in the Lebanon, which must have been buried some centuries before the destruction of Jerusalem by Titus. In the villages the houses are built of sun-dried bricks, and consist of one or more rooms on the ground floor. In cases where there is only one room, there is often a raised dais, on which the family live, while the cattle occupy the remainder. On the roof, in summer-time, are erected booths of leaves or mats, for sleeping and living in. The doors and window-shutters are of rough wood, and there are no chimneys ; the wood fires do not require it. One gets very soon accustomed to the wood smoke. The bricks are made of mud, with chopped straw intermixed, and sometimes a little cow-dung. In some parts cow-dung is flapped against the walls to dry in the sun, to be used subsequently as coal ; but when wood is available, the cow-dung is much used for making boxes and jars, by mixing it with mud and straw. Each house usually contains one or more enormous amphorae, made of mud and cow-dung, in which the corn is kept ; and square boxes are also made of the same material for other stores. The furniture of the poor is usually most simple, consisting only of rush-mats, bedding, and cooking utensils. All houses are plentifully supplied with pottery-jars for holding water, and the potter is constantly at work, for jars are continually broken. One of the most certain indications of an ancient site in Palestine is a heap of broken pottery. Herodotus tells us that, in his day, jars of water were taken from Egypt into Syria ; but this refers, probably, only to those parts of the desert bordering on Egypt. In Jerusalem the potter makes his clay from the red virgin earth found in the limestone port-holes in the neighbourhood, mixed with yellow clay from Olivet, in certain proportions.

Glass has been in use in Palestine since very early times. During the Roman period it was common. It is still made at Hebron ; but it is only now made into glass bottles, and into bangles and bracelets for the women.

Soap is also made in Jerusalem for the people, of olive oil and soda. The soda is derived from saliferous plants by burning them. In the villages are generally many beehives of pottery or bark. Bees are easily kept in Palestine ; and in some parts they hive in the rocks, and honey may be sucked out of the rocks. Travellers have in some instances

found the honey exuding; the Moslem, not requiring the grape for wine, makes it into "dibs" or treacle, so that the culture of bees is not so necessary with them.

In many parts the villages are surrounded by groves of olive-trees, and in some cases, particularly in the mountains, by fruit-gardens. The fellah is a good husbandman, and will work all day in the fields with happiness.

JEWS.—It is constantly stated that the Jews are returning to Palestine in great numbers. This is true, but as they only go there to die, when at an advanced age, the Jewish population does not naturally increase, although, no doubt, there is a steady increase. They occupy four holy cities—Jerusalem, Hebron, Safed, and Tiberias. They are also to be found in the towns on the coast in small numbers. Few of them belong to Palestine—that is to say, they have for the most part returned to Palestine in later times, having been wandering or located in other countries.

Eighteen hundred years ago the Jewish nation had spread in colonies over Assyria, Asia Minor, Arabia, Northern Africa, Greece, Italy, and Spain; and six hundred years ago they were in great force in Arabia, governing districts, where they were 300,000 strong, and had spread from Russia to India and China, and from Arabia to Abyssinia and Nubia. They had also settled in Germany in great numbers. Since then they appear to have been greatly absorbed or to have died out, as they are now chiefly represented by the Jewish population in and about Poland, and the exiles from Spain in Morocco.

The Jews are divided into two powerful sects in Palestine—those from Germany, Russia, and Poland, called Ashkenasim, and those from Morocco (exiles from Spain), called Sepherdim. There is also a small sect of reformed Jews called Careites, who reject tradition, and adhere only to the Scriptures.

The Jews in Jerusalem may perhaps number 10,000, of whom 6000 are Ashkenasim, and 4000 Sepherdim. The latter, coming from a Moslem territory, are rayahs—*i.e.*, ordinary Turkish subjects; while the former, coming under the Capitulations, are treated as foreigners, and are looked after by the consuls. The Sepherdim assert that they were colonists in Spain at the time of the crucifixion, and are in no way responsible for the rejection of the Messiah; and reason, in a very subtle manner, that as He was rejected He could not be the Messiah. And one of the rabbins informed me that the second advent of the Christians will be the coming of the Messiah to the Jews. They dress in Oriental costume, speak the Spanish language, and have the same features as the Jews of Morocco. They are a light-haired, sometimes red-haired, race. They are robust, industrious, accustomed to hard work, honest, straightforward, and are fond of agriculture—which liking they have derived from their sojourn in Morocco, where they till the ground. The Ashkenasim are a very peculiar people, full of the wild fanatical zeal which distinguished the

race so many hundred years ago ; full of religious fervour, and at times so carried away by impulses of passion that they are not amenable to reason.

They are fragile in appearance, but their courage and fortitude make up for want of stamina. Many of them are entirely supported by the *hallukah*, or money sent to them for their prayers for those in other parts of the world, who cannot afford to come themselves. With all their fanaticism, there is a frankness and straightforwardness about them, with which our countrymen cannot fail to sympathise ; and I am bound to say of the Jews generally in Palestine, I found them of great assistance to me, and most friendly, even in matters where their religious conviction might have arrayed themselves against the work I carried on.

Since the destruction of the temple by Titus, the Jews have been in the habit, whenever permitted, of collecting together in Jerusalem to mourn over the lost glories of their ancient city and the house of God ; and in early times were allowed to enter the temple enclosure once a year, to anoint with oil the "protruding rock" of the Sanctum Sanctorum, and "make lamentation, with groans, and rend their garments, and so retire." But in the fourth century they were turned out of the temple enclosure, and only allowed to approach its walls, and there lament, as at the present day. The portion of the old temple now set apart for this purpose is on the west side, and is now called the Wailing Place ; and here the Jews on Friday evenings congregate, and read the book of Lamentations, and rock themselves, and shake their bones in anguish ; for they still follow in this the practice of their forefathers.

LANGUAGE.—The language spoken in Palestine among the people is Arabic, differing in dialect from the Bedouin people of Egypt and of Damascus. The Turkish officials talk Turkish, and some of them do not know Arabic, and are looked upon as aliens by the native population.

GERIZIM AND THE SAMARITANS.—Much has been said and written on the subject of the fertile Gerizim and the sterile Ebal, the Mountain of Blessings and the Mountain of Curses ; but there is little to choose between them. They stand side by side, north and south, the southern slope of each being equally barren, the northern slopes being fertile, on account of their springs, more numerous on Gerizim than Ebal. But inasmuch as the town of Shechem lies between the two mountains, and derives all its water from Gerizim, the idea has gradually been formed by travellers that there is a difference between the two, accounting for their being chosen for the blessings and curses. It is asserted by some writers that Gerizim is identical with the land of Moriah, where Abraham took Isaac, and some go so far as to say that Gerizim was originally intended as the spot where the ark of the covenant was to rest, but that circumstances subsequently forced Jerusalem or Zion upon the people. Of one matter we may be quite certain—of all places in Palestine there is no more fitting place to be found for the ceremony there enacted. In the gorge between the two

mountains are two natural theatres, half a mile in diameter, and facing each other, forming one amphitheatre, in which the assembled hosts of Israel could meet face to face, to hear and respond to the law read by their leader Joshua. Up the valley, and beyond the theatres, is the ancient city of Shechem, now Nablous. It is a peculiarly favoured spot, and its position is lovely—here alone in Palestine at the present day does water ripple in ducts through the streets and courtyards in sufficient quantities to enable the inhabitants to use it liberally without regarding it as a luxury. At all seasons of the year the fountains gush out in never-failing plenty. Mahomet has said—"The place which He (Allah) loveth most in the district of Jerusalem is the mountain of Nablous." This city is the headquarters of the Samaritans, whose existence at the present day at the foot of those holy mountains is one of the most astonishing existing testimonies to the historical accuracy of the Bible. A few years ago this interesting people had outposts and colonies in Damascus and other cities of Syria, and a few centuries ago they extended into Egypt. Gradually they have dwindled in numbers, until at length there are but a few families, numbering in all 130 persons, left as a testimony.

They still cling to the sides of these holy mountains, where they continue to eat the "Passover," as they have done without intermission, except for forty years, for over 2500 years. It is the only known instance of a continuance through so many years of a religious rite. In the fourteenth century we read that they wrap their heads in red linen cloth, as a distinction from the others, and this, or brown, is their present distinguishing badge. In the twelfth century, Benjamin of Tudela speaks of the 100 Cutheans, who are called Samaritans, occupying Gerizim. Josephus tells us that they were Cutheans sent to replace the tribe of Ephraim, transported into Assyria. And we read the same account in the book of the Kings. It is supposed by some that they are of the tribes of Israel, but it cannot be doubted they are Cutheans, sent by the King of Assyria, augmented by recruits from the children of Israel and renegade Jews, taught by priests of the Israelites, sent from Assyria, to lead them to the worship of the living God.

The Jews, since the destruction of the temple, have celebrated the Passover with mutilated ceremony, but the Samaritans have continued it in the original manner.

Their religion is remarkable in its simplicity. It is founded on the five books of Moses, the book of Joshua—beyond this they do not go; it is their all. They are Sadducees—believe in no resurrection; therefore they require no prophets as to the future—no Messiah—no scheme of salvation. It is simplicity itself—a code of morality in this world—and there it all ends!

They are bitter enemies of the Jews, and their possession of a volume of the Pentateuch differing in some respects from that received from the Hebrews is a remarkable confirmation as to the antiquity of our own version. The old scroll purports to have been written by the great-

grandson of Aaron. That it may have been copied from it, is probable, but this in particular is generally ascribed to the thirteenth century. Their old Pentateuch is spoken of by the early Christian Fathers. There are many reasons for supposing that the present scroll is a direct descendant of that brought to them by the Israelite priest. The characters used by the Samaritans closely resemble those on the Moabite Stone and the Assyrian Lion weights. Altogether, the Samaritan customs and records are the most interesting to a biblical scholar that the world possesses at the present day.

I have had the good fortune to be present at the Passover, and to see it celebrated; and, without any hesitation, I would say it is the most remarkable sight now to be seen on earth—it is the one existing connecting link with the far-away past.

CONFIGURATION OF THE CLYDE SEA-AREA.

Read at Meeting of British Association, 1886.

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In a previous paper¹ I was obliged to preface the discussion of temperature and salinity in the deep-water basins of the west coast by a short account of their physical features. The present paper deals more fully with the bathymetrical conditions of the Clyde sea-area, and may be viewed as an extension of the descriptive part of Mr. Cadell's discussion of the configuration of the Dumbartonshire Highlands.²

TOPOGRAPHY.

The general appearance of the Firth of Clyde and its associated lochs is familiar to every one, and the variety and beauty of the scenery it presents are appreciated by all. There is probably no other region in Great Britain so much traversed by visitors bent on business and pleasure, and there is no other which is such a perfect museum of physical geography. On examining a map of this district we see a wide channel running nearly due north between the peninsula of Cantyre and the mainland. The island of Arran lies nearly in the middle of it, and at the upper end it is bounded by the deeply indented peninsula of Cowal. The western corner of the wide channel runs straight up as Loch Fyne, at first to the N.N.W., then curving towards N.E. The eastern corner is prolonged in a N.N.E. direction into Loch Long, and is joined abruptly by the estuary of the Clyde, which runs W. by N. from Bowling. Thus from a purely topographical point of view the water system known generally as

¹ *Scottish Geographical Magazine*, vol. ii. June 1886, p. 347.

² *Ibid.* p. 337.

the Firth of Clyde appears to be only accidentally connected with the river of that name, and is evidently not a true extension of it, as the Firth of Forth is of the stream which gives it origin. In this relation it is specially noteworthy that all the fresh-water lakes, valleys, and channels of the district, as well as those of the west of Cantyre and the depressions between the islands, have a general north and south trend, with the play of a point or two to east or west; while the Clyde river-bed alone runs from west to east. The land traversed by the Clyde from Glasgow to Greenock is flat, contrasting with the elevated character of that to the west and north. Before discussing the bathymetrical conditions I shall describe the commonly accepted geographical divisions.

The *Firth of Clyde* may be said to commence at a line drawn from the Mull of Cantyre through Ailsa Craig to Girvan in Ayrshire, and measured along this line its width is 30 miles. Its eastern boundary swerves to the east, forming a wide sandy bight which includes the bays of Ayr and Irvine. A few miles further north a flat headland appears, extending for a mile from Fairlie Head, and succeeded by a straight coast-line. Here the character of the land changes, the low, gently-sloping shore rising into a series of hills on the boundary between Ayrshire and Renfrew; the highest, Misty Law, attains 1669 feet. At Cloch Point the coast-line turns abruptly towards the east, and, broken only by Gourock Bay and the harbours of Greenock and Port Glasgow, stretches up along the river. The only streams of importance are the Girvan, Doon, Ayr, and Irvine. The western boundary of the Firth of Clyde is at first the southern portion of Cantyre, then the west coast of Arran with its two bays of Lamlash and Brodick, the former converted into a perfect natural harbour by Holy Island. Arran is 21 miles long; the ground rises towards the interior all round and attains its greatest height, 2863 feet, in Goatfell, near the north of the island. From Arran the boundary of the Firth of Clyde is continued across the Sound of Bute by Garroch Head, Kilchattan Bay, and the eastern shore of Bute to Bogany Point. The Cumbræes lie right in the channel, reducing it at the narrowest place to $1\frac{1}{2}$ miles on each side of Little Cumbræe. The boundary crosses to Argyllshire at Toward Point, where the firth is nearly 4 miles wide. The western or northern shore rises into a series of picturesque heights, and on the whole follows the outline of the eastern or southern coast; so that, allowing for the entrances to the Holy Loch, Loch Long, and the Gareloch, the width of the firth varies between 2 and 3 miles until off Port Glasgow, after which it rapidly diminishes.

Kilbrennan Sound, the channel between Arran and Cantyre, is $3\frac{1}{2}$ miles wide at its upper entrance, runs at first S.W., then curves to a southward course, contracting to 3 miles at Carradale, and finally widening out towards the south of Arran, where it merges into the Firth of Clyde.

Bute Sound is a short wide piece of water between the north-east shore of Arran and the south-west of Bute.

Inchmarnock Water, named from the little island of Inchmarnock to

the west of Bute, is the meeting-place of the Kyles, Loch Fyne, and the Sounds of Kilbrennan and Bute.

The Kyles of Bute form a narrow tortuous channel, separating the north end of Bute Island from the mainland. A group of small islets at the northerly bend lies across the mouth of Loch Ridun, into the head of which the river Ruel falls.

Loch Fyne bears the same relation to Kilbrennan Sound and the Firth of Clyde that Loch Ridun does to the West and East Kyles. It is the largest of the sea-lochs, being 41 miles in length from Ardlamont Point to the head, and varying in width from 5 miles at Ardlamont Point to $\frac{1}{4}$ at Cuill. Loch Gilp terminates the northern extension of Loch Fyne, which then turns to the north-east. Loch Gair, a mere bay, and Loch Shira, similar in all but size to Loch Gilp, branch off to the north. The largest streams run parallel to Loch Fyne on both sides, and, with the exception of the Aray, the Shira, and the Fyne near its head, only mountain burns flow into this fiord. Loch Fyne is roughly parallel to the upper part of the Firth of Clyde, and all the lochs branching off the latter run towards it.

Loch Strivan, 9 miles long and from 1 to $\frac{1}{2}$ wide, runs N. by W. from opposite Rothesay Bay. A tongue-shaped piece of land—Strone Point—separates it from the Kyles.

The Holy Loch, a bay $2\frac{1}{2}$ miles long, runs N.W., parallel to the Kyles. It is connected by the river Eachaig, 3 miles in length, with Loch Eck, a fresh-water lake running parallel to Loch Strivan and Loch Goil.

Loch Long, separated from the Holy Loch by a tongue-shaped Strone Point, runs N. by W. for 5 miles with a width of $1\frac{1}{2}$ miles to Ardentinn, then, contracting to from $\frac{2}{3}$ to $\frac{1}{2}$ a mile, continues in a N.N.E. direction $12\frac{1}{2}$ miles farther, where it terminates at Arrochar, 2 miles from Tarbet on Loch Lomond.

Loch Goil.—Four miles above Ardentinn, the mountain wall on the west side of Loch Long, is broken by the entrance of Loch Goil, which stretches northwards for 7 miles in a gentle double curve.

The Gareloch runs for $6\frac{1}{2}$ miles from Helensburgh, N.N.W. and reaches to within a mile of the mouth of Loch Goil.

With the exception of the Gareloch and Holy Loch, all these long narrow inlets are surrounded by lofty mountains, rising to nearly 2000 feet close to the water's edge.

These, the divisions commonly met with on maps, are not by any means truly descriptive of the conformation of the sea-area, which is much simpler than the great number of names employed would lead one to suppose.

CONFIGURATION.

I shall now describe the region with special reference to the accompanying chart, for the construction of which I am indebted to Mr. J. G. Bartholomew. It represents differences of level on the uniform

plan of deeper colours for greater depths. The scales for land and water are different. On land, heights above 2000 feet are represented in light brown, and the spaces between the contour lines of 2000, 1000, 500 feet, and sea-level are printed in deepening shades. The sea-bottom is contoured at 10, 30, 50, and 80 fathoms, and the intervening spaces tinted in progressively darker shades of blue. Loch Lomond is treated as if it were part of the sea, but the other fresh-water lakes are coloured light blue irrespective of their depths. The sea-water under 10 fathoms deep, represented by the palest shade of blue, may be imagined as a thin film of water spilt over the dark brown of low-lying land.

Taking into account the features emphasised by this chart, we may define and divide the district as follows. To divest the mind of any misleading idea as to the region under consideration being a river entrance such as the Firth of Forth, I use the words "Clyde Sea-Area" as a convenient term for the whole connected water-system inside the peninsula of Cantyre, and, if it were not for an accidental 30 feet of land, would extend it to include Loch Lomond and Loch Eck as well.

The *Clyde Sea-Area* may be taken as bounded on the south by a line drawn from the Mull of Cantyre to Corsewell Point in Wigtownshire, almost coinciding with the contour of 50 fathoms. The whole area of water at high tide within this line, including all the channels, bays, and sea-lochs, is 1300 square miles. It is divided according to depth in the following manner:—

Depths exceeding 80 fathoms,				occur over 10 square miles.	
"	between 50 and 80 fathoms,	"	"	100	"
"	" 30 " 50 "	"	"	450	"
"	" 0 " 30 "	"	"	740	"

Clyde Barrier Plateau.—From the southern boundary line indicated above, the water shoals gradually, until at a line joining Sanda Island and Bannan Head in Ayrshire, it is about 25 fathoms deep. The average depth over a plateau of 270 square miles, which terminates near a line joining Davaar Island, off Campbeltown, to Turnberry Point in Ayr, is about 27 fathoms. This Clyde Barrier Plateau forms a wide ridge between the deep water on each side, and in the middle of it, 10 miles from Girvan, the rocky islet of Ailsa Craig, two-thirds of a mile in diameter, rises to a height of 1097 feet above the water, or 1250 feet above the sea-bottom. The 25-fathom contour line bounds a double triangle of shallow water, the apices meeting near Ailsa, and the bases running along the coasts of Cantyre and Ayrshire. Thus there is deeper water to the north and south of Ailsa than to the east and west, and the rock rises close to the narrowest part of the ridge. Two basins and five loch-troughs are clearly marked out inside the plateau, and their outline may be followed on the chart by the 30-fathom contour line.

Arran Basin.—The largest basin, shaped like the letter λ, comprises the channel on both sides of Arran, and extends up Lower Loch Fyne, nearly as far as Otter Ferry. Although this depression has been named

the Arran Basin, it also partly surrounds the Little Cumbrae, runs up the channel past the south of Bute to near Bogany Point, and up the west Kyles to near Blair Ferry. The depth in this basin exceeds 30 fathoms over 340 square miles, of which 100 exceed 50, and 10 exceed 80 fathoms in depth. The trough of deepest water (more than 80 fathoms) extends as a submarine gully, about half a mile wide, for 20 miles in a north-westerly direction through the Sound of Bute, Inchmarnoch Water, and Lower Loch Fyne. It attains its greatest depth (107 fathoms) at a point 1 mile west of Skate Island, near Tarbert. A detached portion of this trough lies in the same straight line, a few miles beyond each end. The contours approach the shore most closely, i.e. the slope is steepest, around the north of Arran.

Bute Plateau.—A plateau, with an average depth of about 20 fathoms, passes from the Great Cumbrae across to Toward Point, and through Rothesay Bay, dividing the southern from the northern basins.

Dunoon Basin.—A narrow tract of water, with an average depth of 40 fathoms, runs N. by E. from the north end of Great Cumbrae, close along the Renfrew shore, and continues up lower Loch Long to the Dog Rock, opposite the entrance of Loch Goil, at "Argyll's Bowling-green," a length of 21 miles. Its greatest depth, 56 fathoms, occurs off Dunoon.

Estuary.—The 5-fathom contour line extends no farther east than Greenock; and the Estuary of the Clyde—a name applied to the water extending from a line drawn between Greenock and Helensburgh to Bowling—is extremely shallow, the channel being only kept open for navigation by constant dredging.

The *Gareloch*, above Row Point, where the depth is under 5 fathoms, has an area of about 5 square miles, and an average depth of 20 fathoms in the centre. It is surrounded by low-lying land, the elevation between it and Loch Long being less than 500 feet; on the north-eastern side the land is higher, but the hills are distant. No streams of importance flow into the Gareloch.

Upper Loch Long and *Loch Goil* are of equal area, 4 square miles. Each consists of a deep trough cut off by a narrow ridge from the Dunoon Basin, and descending in Loch Long to a depth of 35 fathoms, in Loch Goil to 47. The sides are precipitous in many places, and present an almost unbroken mass of mountain. The 1000-feet contour comes within half a mile of the water's edge, and hills of over 2000 feet run along both sides of each loch.

Loch Strivan, 5 square miles in area, appears to differ from the other loch basins, in as much as it is a depression on the Bute Plateau, not the barred-off end of a submarine gully. It is surrounded by land rapidly rising to over 1000 feet, and, as in other cases, innumerable torrents score the mountain sides and hurry the rainfall into the water.

Upper Loch Fyne, 25 miles long from the narrow channel at the great Otter Spit to the head at Clachan, has an area of 20 square miles; and a depth, along the centre, gradually increasing from 30 fathoms at Gortans to 40 at Furnace and 80 at Strachur, then shoaling to 70 near Inveraray, 30

at Dunderave, and 15 at Cuill. The land along Loch Fyne, especially on the north-western shore, has a comparatively gentle slope, and the hills are not very high. The upper 6 miles are, however, surrounded by hills both high and steep; and this portion is particularly subject to the influence of fresh water, as, in addition to the innumerable torrents that spring into being after every shower, it receives several rivers.

The Kyles of Bute, Loch Ridun, and the Holy Loch have not been taken into special consideration, as they seem to be simply extensions of the Bute Plateau and Dunoon Basin.

The ragged peninsula of Cowal, between Loch Lomond and Loch Fyne, has, including Bute its natural pendant, an area of 460 square miles. Of this, 170 square miles, chiefly at the south-western end, have a height under 500 feet; elevations of from 500 to 1000 feet cover 150 square miles; heights from 1000 to 2000 cover 125, and in the north-east there are 15 square miles of the earth's surface covered by mountain summits of over 2000 feet. These 15 square miles of great elevation are associated with the 8 square miles of Loch Long and Loch Goil, and 10 square miles of Upper Loch Fyne; but some of the drainage of the eastern slopes finds its way to Loch Lomond. The deep lochs winding amongst these mountains are profoundly affected by their surroundings, both as regards the temperature and the salinity of the water. This piece of country is intersected by a number of remarkable valleys, either running from sea to sea like that of Loch Eck, or simply pushing their way into the interior like Glendaruel.

The relation between height of land and depth of sea appears from the chart to be very intimate. In the deep loch basins at the Mull of Cantyre, and round the north of Arran, high and precipitous land is associated with exceptionally deep water and a steep gradient. Along the Ayrshire coast, very low land and a gradually sloping shore are associated with shallow and slowly deepening water; while farther north, where the land rises, deep water comes close inshore. The exceptions to this generally accepted rule are no less remarkable than the concurrences. Between the low-lying headlands of the south of Bute and Little Cumbrae there is water of great depth (more than 70 fathoms), and the plateau of comparatively shallow water between the Mull of Cantyre, the south of Arran, Ailsa Craig, and South Ayrshire, is not apparently connected with any special flatness of the shores. This plateau is a very interesting feature, and suggests many hypotheses to account for its origin. Regarded from one point of view, it is only a repetition, on a much larger scale, of the bars marking off loch-troughs that characterise this whole sea-area, and might thus appear to have been formed subsequently to the main features. On the other hand, the plateau of 25 fathoms may be supposed to have formerly extended over the whole area, the various basins being scooped out in it. The origin of physical features is not, however, the subject of this paper, and it has merely been alluded to in order to direct special attention to the existence of the plateau.



NOTE.

The colouring of the map is designed to show with special effect the area and depths of the Firth of Clyde and its inlets or what Dr Mill calls the "Clyde Sea Area." For this purpose the land and sea have been treated separately, and coloured in strong contrast to each other. The

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Observations on the specific gravity and temperature of the water of the Clyde sea-area at all times of the year confirm by their results the divisions just described, viz.:—The Channel, the Barrier Plateau, the great Arran Basin, the Dunoon Basin, the troughs of Upper Loch Fyne, Loch Strivan, Loch Gail, Upper Loch Long, Gareloch, the Bute Plateau, and the Estuary. If the term “Firth,” as physically defined,¹ is to be applied to any part of the sea-area, it must be to that between Port-Glasgow and Toward.

FÂ-HIEN'S TRAVELS IN INDIA.²

BY J. W. M'CRINDLE, M.A., M.R.A.S.

BETWEEN the fourth and eleventh centuries of our era, India was frequently visited by Chinese Buddhists, who came on pilgrimage to view the consecrated scenes amid which their great teacher had spent the years of his earthly existence. They were for the most part devout monks, whose object in travelling so far abroad was not merely to render their tribute of worship at the holiest shrines of their faith, but also to obtain copies of their sacred books, and to learn the Sanskrit language, in which these had been written and authoritatively expounded. On this account their sojourn in India was in some instances extended over a good many years. The names of two of these scholarly pilgrims, Fâ-hien and Hiouen-Thsang, are now quite familiarly known throughout the republic of letters, a distinction due to the fact that they wrote accounts of their Indian travels, which, within the last fifty years, have been translated into several European languages, and have been found extremely useful to students of Buddhism, and to Indian archaeologists.

Fâ-hien, who preceded Hiouen-Thsang by a couple of centuries, came from Ch'ang-gan,³ now Si-gnan, a town of Shen-se, one of the northern provinces of China. He started on his long and perilous journey in the year 399 A.D., and did not return home till some fourteen years afterwards. The greater part of the intervening years he spent in India, visiting its monasteries and shrines, learning Sanskrit, and seeking to procure canonical works on the doctrine and discipline of his faith. The work of which he was especially in quest was one which contained the rules of discipline observed at the first great council of Buddhism, which had been held while Buddha was still in the world.⁴ His search was not

¹ Mill and Morrison, Tidal Variations in Estuary of Forth, *Proc. R.S.E.* xiii. 1886, June 7.

² *A Record of Buddhistic Kingdoms*: Being an Account by the Chinese Monk, Fâ-hien, of his Travels in India and Ceylon (A.D. 399-414), in search of the Buddhist Books of Discipline. By James Legge, M.A., LL.D. Oxford: Clarendon Press, 1886.

³ This is the Kenjan-fu of Marco Polo, and perhaps the Thinae of Claudius Ptolemy. It was probably, says Colonel Yule, the most celebrated city in Chinese history, and the capital of several of the most potent dynasties.

⁴ This work was called the *Vinaya Pitaka*.

rewarded until he came to Pataliputra, where he found a complete copy of the rules, with full explanations, in one of the great monasteries of that place. Here he remained for no less than three years, studying and copying this work, and improving his knowledge of Sanskrit.

In *Pataliputra* (now Patna) the reader will readily recognise the *Palibothra* of the Greeks, and will thus be reminded that this was the city where, seven centuries before the time of Fâ-hien, Megasthenes, the Greek ambassador at the Court of Sandrakottos,¹ also resided, and where he collected the materials out of which he composed his celebrated *Description of India*.

From Patna, Fâ-hien slowly proceeded southwards till he came to Tâmalipiti (now Tam-luk), near the mouth of the Hoogly, where he spent two years in copying books and drawing pictures of images. At this port he embarked for Ceylon, and, after spending other two years in that island, sailed for China, which he reached in safety, after having been exposed, however, to many perils and hardships of the most trying kind during the voyage. Soon after his return he wrote, or rather dictated, an account of his Indian travels, at once simple, yet graphic, and truthful as far as what he heard and saw is concerned.

The work was not known outside of China till half a century ago, when it was unearthed by the great Chinese scholar Abel Rémusat, and presented to the world in a French translation which he had himself prepared. The work, on becoming known through this medium, was at once seen to be a source of most valuable information regarding one of the darkest periods of Indian history—that which was comprised between the middle of the second century A.D., when Greek authors ceased to write about Indian affairs, and the era of the Mohammedan conquest, about the year 1000, from which date the course of the national transactions can be clearly enough traced. Sanskrit literature might have been expected to supply the necessary enlightenment, but the Indian sages, absorbed in the dreams of philosophy, cared little for the concerns of practical life, and left the history of their country untold.²

Rémusat's version did not long hold the field. He was unfortunately cut off before he had time to revise it, and from this circumstance, as well as from the difficulty—which it took much labour after his time to surmount—of converting Indian names, as phonetically represented in Chinese, back into their proper Sanskrit forms, his version was far from being sufficiently accurate. Several other versions have appeared in succession, all from the pens of most competent scholars, and all enriched with copious annotations. The latest is that which has just been published by

¹ He was sent as ambassador by Seleukos Nikator, king of Syria (from 312 to 280 B.C.), who had entered into an alliance with Sandrakottos, king of Magadha (Behar), to whom he ceded the Greek settlements in the Panjab and Kabul Valley, and to whom he also gave his daughter in marriage. *Sandrakottos* is a pretty close transliteration of the Indian name *Chandra Gupta*.

² No trace has as yet been found in any Sanskrit work of such an important episode as the Macedonian invasion.

Dr. Legge, the Professor at Oxford of the Chinese language and literature, and who, when a missionary in China, where he resided for thirty years, made the Confucian classics a special subject of study. We learn from his preface that he spent much time and care in its preparation, and did not omit to make frequent reference to previous translations. It may therefore be accepted as the most authoritative exposition of his author's sense that has yet appeared, and as perhaps superseding the necessity for any further translation being made. Several recensions of the narrative exist, and of these Dr. Legge has chosen the Corean as the best. He has appended it to the translation, together with all the variant readings found in the other recensions, so that the text is exhibited in an altogether complete form. The notes, which are copious, are meant partly to explain passages or expressions which would be obscure to an English reader, and partly also to illustrate the history and doctrines of Buddhism. Little more is claimed for them than the merit of selection and condensation, but they give ample proof of the exact and varied learning of the writer. A sketch-map is given of Fâ-hien's travels, and also a series of pictures, nine in number, "taken from a superb edition of a history of Buddha, profusely illustrated in the best style of Chinese art."

But we must now pass on to consider the narrative itself. As might be expected, it abounds with details of Buddhist monastic life, and never fails, when an opportunity occurs, to refer to some miracle, however grotesque in its character, said to have been performed by Buddha. We shall touch, however, as little as possible on such topics, and confine our remarks almost exclusively to questions of geography on which the work throws light. We propose, therefore, while tracing the pilgrim's route, to show how the more important places which he visited have been identified, and in some instances to notice the description which he has given of them. Most of these places have now been, with more or less certainty, identified, thanks to the labours of such scholars as Stanislas Julien, Klaproth, Beal, and Dr. Eitel, and to the researches of General Cunningham (son of our Border poet, Allan Cunningham), who was for many years Director of the Indian Archaeological Survey Department. Two causes operated to make their identification difficult. The first has already been indicated in the statement that Indian names are hard to recognise under the forms which they assume in Chinese. The second is that not a few of the places mentioned by Fâ-hien are either now no longer known by their old names, or have long ceased to be numbered among the things that are, some having been destroyed by war, some buried under desert sands, some forsaken by the rivers on whose banks they stood, and some swept away by resistless floods.

Regarding Fâ-hien himself little is known beyond what can be gathered from his work. He was a native of Ch'ang-gan, and was brought up in a monastery of that place, even from his earliest years. He was noted alike for his clear intelligence and for the sincerity and fervour of his religious convictions. He had not long finished his novitiate and taken full

Buddhist orders, when he undertook his journey to India for the objects already stated. After starting from Ch'ang-gan, and passing through Lung, a country in the extreme west of Shen-se, he came to the kingdom of "the Western T'sin," where he and his companions stopped for the summer retreat, which extended from the middle of the fifth to the middle of the ninth Chinese month. When this period of devotion was ended, the pilgrims went forward till, after crossing the mountain of Yang-low, they reached Chang-yih, a trading mart in the province of Kansu, and just within the north-west extremity of the Great Wall. Here they fell in with a party of five pilgrims, bound, like themselves, for India, and with these they remained together in Chang-yih during the summer retreat of that year. We find them, after departing thence, making their next halt at a frontier town of Tangut, called T'un-hwang, which lay at some distance beyond the termination of the Great Wall, and on the edge of the vast "Sea of Sand," the Sahara of Asia, the terrible desert of Gobi. This desert is of vast extent, stretching from the eastern frontier of Mongolia to within six miles of Ilchi, the chief town of Khoten, and thus comprising in length 33 degrees of longitude, while it varies in breadth from 3 to 10 degrees of latitude. "It would take," says Marco Polo, who himself traversed it, "a year and more to ride from one end of it to the other; and here, where its breadth is least, it takes a month to cross it." It was a great task which the pilgrims had now before them to make their way through the western portion of this desert. The Prefect of T'un-whang, however, supplied them with all the means necessary for their passage through it, which occupied seventeen days, and must have been very rapidly performed, as the distance traversed was about 1500 le, or upwards of 400 miles. Fâ-hien's account of the dangers and desolate aspect of this sandy waste agrees closely with the accounts given afterwards both by Hiouen-Tsang and by Marco Polo. "In the desert," he says, "are many evil demons and hot winds. Travellers who encounter them perish all to a man. There is not a bird to be seen in the air above, nor an animal on the ground below. Though you look all round most earnestly to find where you can cross, you know not where to make your choice, the only mark and indication being the dry bones of the dead left upon the sand." It may seem somewhat singular that the three travellers are quite at one in representing the desert as haunted by evil spirits; but it is a well-established fact that the solitude of the wilderness, no less than the solitude of night, oppresses some minds with superstitious terrors, which the force of reason is altogether impotent to allay. Hiouen-Tsang relates that in his passage through this desert, both outward and homeward, its demons sought to scare him both by visual illusions and by mysterious voices.

On emerging from the desert the travellers found themselves in the kingdom of Shen-Shen, which is described as a rugged and hilly country, with a thin and barren soil. Its capital city lay not very far from the lake called Lob (or Lop) Nor, into which the Tarim discharges, after a

course of 1500 miles. The people were Buddhists after the Indian pattern, and the monks were all students of Indian books and the Indian language. After remaining here for about a month, Fâ-hien resumed his journey, and, pursuing on foot a direction towards the north-west, reached Woo-e, a place which has not yet been identified, but which may be located in Karaschar, or between that and Kutscha, in about 44° N. lat. and 81° E. long. This was the culminating point of his advance northward. He was here rejoined by some of his companions, whom he had left behind on the other side of the desert. He remained in a monastery of this place for more than two months, when the niggardly hospitality of the people obliged him to depart. His route lay to the south-west, through an uninhabited country, where the streams were difficult to cross, and where he and his party endured sufferings which he declares to have been unparalleled in human experience.

But this purgatorial region, which it took upwards of a month to traverse, ushered the pilgrims into a land which, by the contrast, seemed a paradise in their eyes. This was Khoten, or, as Fâ-hien writes it, Yuteen. "It is," he says, "a pleasant and a prosperous kingdom, with a numerous and flourishing population." The inhabitants were all Buddhists, and of monks there were myriads. Great hospitality was shown to travelling monks, from whatever quarter they came. Spare rooms were made for their use in every monastery, and all their wants were abundantly supplied. The lord of the country himself lodged our pilgrims in a great monastery called Gomati, and maintained them there at his own expense. No fewer than 3000 monks were attached to this monastery, all under a discipline of silence like the Trappist monks of the present day. "They are called to their meals," says Fâ-hien, "by the sound of a bell. When they enter a refectory, their demeanour is marked by a reverent gravity, and they take their seats in a regular order, all maintaining a perfect silence. No sound is heard from their alms-bowls and other utensils. When any of these pure men require food, they are not allowed to call out for it, but only make signs with their hand." Here Fâ-hien remained several months, unwilling to depart until he had seen a great festival which extended over fourteen days, and the main feature of which was a procession of images, attended by the king himself, and all the members of his court. On leaving Khoten, a journey of twenty-five days brought him to the kingdom of Tsze-hoh, where the sovereign was a strenuous follower of Buddhism, and had around him more than 1000 monks. Tsze-hoh cannot be with certainty identified; it can hardly be Yarkand, as Beal thought; but Tash-kurgan in Sirikul, which has been suggested for it, seems to answer the indications better. The travellers, after having halted here for fifteen days, went southward, and in the course of four days found themselves in Yu-lhwuy, among the Ts'ung-ling Mountains, which are a portion of the great Kuen-lun range, and comprise the Karakorum and Pamir ridges. The name signifies "Onion Mountains," and was given either because the region produces

many onions, or because of the round boulders with which the mountains are covered.

At Yu-hwuy, which corresponds perhaps to the Aktisch of our present maps, the pilgrims halted to keep their retreat; and, when this was over, went on among the hills for twenty-five days, and arrived at K'eeh-ch'a. This was the capital of a kingdom, and evidently a place of considerable importance, but opinions differ as to its locality. Beal says it is certainly Kartchou, to the east of which flows the Mang-tsin River, and which is placed on all maps to the south-west of Yarkand. Dr. Legge prefers Klaproth's view, that it was Iskardu or Skardo, though he admits that some difficulties attend its acceptance. It has, however, he says, the great advantage in its favour of bringing the pilgrims across the Indus. The passage of the river could be easily accomplished at that point, and this would explain the circumstance, not easy to account for otherwise, that Fā-hien makes no particular mention of this important incident. Be this as it may, he arrived in the city at a very opportune time, for the king was then holding the great quinquennial Assembly, this being an ecclesiastical conference for general confession of sins and inculcation of morality. It is said to have been first instituted by King Asoka, who was the grandson of Chandra Gupta, and who established Buddhism as the State religion of his vast dominions about two and a half centuries before our era. When this great synod is to be held, the king, we are told, requests the presence of the S'ramans (priests) from all quarters of his kingdom. They come in clouds, and proceed at once to decorate their assembly hall with silken flags and canopies of state, and a throne for their moderators. The king takes a very prominent part in the proceedings. During the assembly, he and his ministers present their offerings, according to rule and law; and, when it rises, they distribute among the members all sorts of precious things such as S'ramans require. When the distribution, however, has taken place, the king, it is remarked, redeems whatever he wishes from the monks.

The country, being in the midst of the Onion Range, is cold, and wheat is the only cereal which the climate can ripen. Fā-hien, on going forward through these mountains, found the plants, trees, and fruits to be all different from those of the land of Han (China), excepting only the bamboo, pomegranate, and sugar-cane. He succeeded in passing the range, after being on the way for a month in proceeding westward towards North India. The people of the country, he says, call the range by the name of "The Snow Mountains," since the snow rests upon them both winter and summer. He would have us believe that they are infested with venomous dragons, which, when provoked, spit forth poisonous winds, and cause showers of snow and storms of sand and gravel, and also that not one in ten thousand of those who encounter these dangers escapes with his life. He and his party, however, emerged from them in safety, and then found themselves in a small kingdom of North India called T'o-leih. This, Eitel and others

would identify with Darada, the country of the ancient Dardae, the region near Dardus.¹ But Dr. Legge is in more than doubt upon this point, for, as he reads the narrative, Fā-hien was here on the eastern bank of the Indus, and only crosses to the western bank, as described in the chapter immediately following. The travellers now went on to the south-west for fifteen days, at the foot of the mountains, and following their range. "The way," says Fā-hien, "was difficult and rugged, running along a bank exceedingly precipitous, which rose up there, a hill-like wall of rock 10,000 cubits from the base. When one approached the edge of it, his eyes became unsteady, and if he wished to go forward in the same direction there was no place on which he could place his foot, and beneath were the waters of the river called the Indus. In former times men had chiselled paths along the rocks, and distributed ladders on the face of them, to the number altogether of 700, at the bottom of which there was a suspension bridge of ropes, by which the river was crossed, its banks being there 80 paces apart." General Cunningham's description of the course of the Indus in these parts is in striking accordance with our pilgrim's account. "From Skardo to Rongdo," he says, "and from Rongdo to Makpou-i-Shang-rong, for upwards of 100 miles, the Indus sweeps sullen and dark through a mighty gorge in the mountains, which, for wild sublimity, is perhaps unequalled. . . . Between these points the Indus raves from side to side of the gloomy chasm, foaming and chafing with ungovernable fury. Yet even in these inaccessible places has daring and ingenious man triumphed over opposing nature. The yawning abyss is spanned by frail rope bridges, and the narrow ledges of rocks are connected by ladders, to form a giddy pathway overhanging the seething caldron below."

The point where our pilgrims crossed from the left to the right, or Afghan bank of the Indus, must have been upwards of sixty miles above Attok, for at that distance above the great ferry, the river escapes from the mountain gorges, where suspension bridges are required for crossing it. On gaining the other side, they immediately came to the kingdom of Woo-Chang, the Udyāna of Sanskrit writers—a name by which they designated that region lying between the Indus and the river Swat, or Sweti, which is now inhabited by the warlike tribes of the Yuzofzaïs. It was called Udyāna, that is, "The Park," on account of the rich verdure and fertility of its valleys. It was a flourishing seat of Buddhism in Fā-hien's time. It contained, he says, 500 monasteries, the monks of which were attached to the system called the Little Vehicle, that is, the Canon of the Southern Buddhists (promulgated by Asoka, 244 B.C.), in contradistinction to the Great Vehicle, or the Canon of the North, which was followed in Tibet and China, and was of later origin. The people assimilated not only in their religion, but also in language, dress, and diet to the people of Middle India. They have a tradition that when

¹ Legge, in his note, gives the position as lat. 30° 11' N., long. 73° 54' E., but 30° must surely be a mistake for 36°.

Buddha came to North India, he visited their country, and left behind him a print of his foot, which is long or short according to the ideas of the beholder on the subject. They show also the rock on which he dried his clothes, and the place where he converted the wicked dragon. A century after Fâ-hien's visit, the Buddhism of Udyâna was suppressed by a fierce persecution, in which the blood of its priests was shed like water, and the monasteries which lined the banks of the Swât were laid in ruins. In this favoured country the pilgrims kept the summer retreat, and, when that was over, descended south till they arrived in the district of Sooho-to, which is perhaps the part of Udyâna called Swastene, along the lower course of the Swat River, which is the *Sou-astos* of the classical writers.

Proceeding eastward from this for five days, they came to the country of Kin-to-wai, the place where Dharma-vivardhana, the son of Asôka, ruled, and where consequently the people were for the most part adherents of the *hinayâna* or "Little Vehicle." Kin-to-wai, or rather Kin-to-lo, stripped of its Chinese disguise, reveals to us Gandhâra, a name of old renown, mentioned in the Vedic hymns, and familiar to readers of Herodotus, who includes its people along with three others in the seventh satrapy of Darius. It extended eastward as far as the Indus, and westward as far as Jalâlâbâd. "Within its limits," as Cunningham observes, "stood several of the most renowned places of ancient India, some celebrated in the stirring history of Alexander's exploits, and others famous in the miraculous legends of Buddha, and in the subsequent history of Buddhism, under the Indo-Skythian prince, Kanishka.

On leaving Gandhâra, Fâ-hien, after journeying eastward for seven days, reached the kingdom of Takshasîla, the name of which, when interpreted, means, he says, "the severed head," and has reference to Buddha's act of almsgiving, when he gave away his very head to a man out of pure charity. The word, however, means "hewn rock," and the city may perhaps have got its name from its having been built of stone instead of brick or mud, like most Indian towns. Cunningham identifies this place with the Taxila of the Greeks, which, in Alexander's time, was a great and flourishing capital, situated between the Indus and the Hydaspes—now the Jhelam. If he is correct in this, then our pilgrim must have recrossed the Indus in order to reach it, but he does not appear to have done so till he had visited several additional places of interest which lay to westward of the river. Dr. Legge is inclined to solve the difficulty by supposing that there was a Takshasîla on each side of the Indus; but this is to cut, not to untie the Gordian knot. The pilgrims travelled for two days longer to eastward, and reached the place where Buddha threw down his body to feed a starving tigress, and where also there were splendid topes—that is, pagodas¹—to which the devout came with their offerings in an incessant stream from all the surrounding country.

¹ A tope is a dome-shaped tumulus erected over sacred relics of Buddha, or on spots consecrated as the scenes of his acts. The word represents the Sanskrit *stûpa*, of which the Pâli form *thupa* appears in Chinese as *t'ah* or *t'ap*.

The next place to be visited was Purushapura, a kingdom which lay southward from Gandhâra, at the distance of four days' journey. The name under which it is now known is Peshâwar, our frontier station beyond the Indus. Fâ-hien found it adorned with a pagoda which had been built by Kanishka, and which he declares to have surpassed in solemn beauty and majestic grandeur all the topes and temples which he saw in the course of his journeyings. In this country was preserved one of the most precious relics of Buddha—his alms-bowl—about which many legends were current. It was kept in a tope, to which a monastery of 700 priests was attached, and was publicly exhibited twice a day; once before the mid-day meal, and again in the evening, at the time of incense. Every one cast into it an offering of flowers. Those offered by a poor person, however few, filled it, we are told, far more readily than the many which the rich cast in out of their abundance.

At this place, Fâ-hien's companions all left him. Some had gone forward in advance, some had started to return to China, and one came to his end in the monastery of Buddha's alms-bowl. He thereupon resumed the staff of pilgrimage, and went forward alone to the place of the flat-bone of Buddha's skull, which was deposited in a vihâra (shrine),¹ in the city of He-lo, the present Hidda, which lies west from Peshâwar, and 5 miles south from Jalâlâbâd. This relic was held in extreme veneration, and was guarded with the most jealous care. Every morning it was exhibited to the gaze of adoring multitudes, whose homage was expressed by offerings of flowers and incense. The precincts, however, of this holy shrine were, like the temple at Jerusalem in the days of our Lord, profaned with traffic; for, as the pilgrim tells us, in front of the door of the vihâra there are parties who every morning sell flowers and incense, and those who wish to make offerings buy some of every kind.

The next halting-place was only a few miles distant from Hidda. This was Nanghenhar, the Nagara-hâra of Sanskrit writers, and the Na-kie-lo-ho of Hiouen-Tsang. It was called also Udyânapura—that is, "the City of Gardens;" and this name the Greeks, from some resemblance in the sound, translated into Dionysopolis—that is, the "City of the Wine-God." It was the capital of the kingdom of Nagara—a small territory extending along the southern bank of the Kabul river, from the neighbourhood of Jagdalak, as far eastward as the Khaiber Pass. Its site was first indicated by Masson, and afterwards was precisely determined by Mr. Simpson, who, when resident for some months, during the late Afghan war, in Jalâlâbâd, took the opportunity of investigating the antiquities of its neighbourhood. He states that at the distance of 4 or 5 miles west from Jalâlâbâd, he found numerous remains of what must have been an ancient city lying along the right bank of the Surkhâb, a small tributary of the Kabul river. As the natives on the spot applied to the ruins such

¹ A vihâra is the residence of a recluse or priest, and sometimes used as a shrine or temple. The province of Behar was so called from the great number of its vihâras.

names as "Nagrak," "Nagarat," or "Nagara," and as their situation corresponded in all respects with the description of the position of the old city in Hiouen-Tsang, no doubt could remain of the correctness of the identification.

About three miles south from these ruins, is the celebrated rock-cavern in which Buddha left his shadow. "Looking," says our pilgrim, "at this cavern from a distance of more than ten paces, you seem to see Buddha's real form, with his complexion of gold, and his characteristic marks in their nicety, clearly and brightly displayed. The nearer you approach, however, the fainter it becomes, as if it were only in your fancy. When the kings from the regions all around have sent skilful artists to take a copy, none of them have been able to do so. Among the people of the country there is a saying current that 'the thousand Buddhas must all leave their shadows here.'" Fâ-hien at this place rejoined two of his companions, who had pushed on thither, a considerable time before him; and along with these, in the third month of winter, he proceeded southward, crossing the Little Snowy Mountains, probably with a view to gain the Kohat Pass. In the course of this trying journey, an incident occurred which Fâ-hien records with a simplicity and pathos almost scriptural: "On the north side," he says, "of the mountains, in the shade, they suddenly encountered a cold wind, which made them shiver and become unable to speak. Hwuy-King could not go any further. A white froth came from his mouth, and he said to Fâ-hien, 'I cannot live any longer. Do you immediately go away, that we do not all die here;' and with these words he died. Fâ-hien stroked the corpse, and cried out piteously, 'Our original plan has failed; it is fate. What can we do?' He then once more gathered up his strength, and pressed forward on his way."

Having succeeded in crossing, with the companion still left him, to the south of the range, he arrived in the kingdom of Lo-e or Rohi. This is a name of Afghanistan, but of course only a portion of it can be here intended. Here the pilgrims stayed for the summer retreat, and, this being over, they went on to the south for ten days, and reached the kingdom of Poh-na (that is, the district now called Bannu), where there were more than 3000 monks, all adherents of the southern form of Buddhism.

A journey of three days from Bannu brought them to the Indus, which they again crossed, but now at a place where the country on each side was low and level. When the people on the side to which they had crossed saw their fellow-disciples from T'sin (China) passing along, they were moved, says Fâ-hien, with great pity and sympathy, and expressed themselves thus: "How is it that these men, from a border country, should have learned to become monks, and come for the sake of our doctrines from such a distance in search of the law of Buddha?" They accordingly supplied all the wants of the strangers, and treated them in accordance with the rules of the law. Fâ-hien gives no details of his journey

through the Panjâb, and the regions watered by the Jumna, until he reached the great city on the banks of that river, Ma-t'âou-lo, that is Mathura or Muttra,¹ so famous as being the birthplace of Krishna, and the scene of his adventures with the milkmaids. All the country south from this is, he says, named the Middle Kingdom. His description of this part of India, and his impressions regarding the character and condition of its inhabitants, are, in the main, in agreement with the accounts given seven centuries earlier by Megasthenes. "In the Middle Kingdom," he says, "the cold and heat are finely tempered, and there is neither hoar-frost nor snow. The people are numerous and happy; they have not to register their households, or attend to any magistrates and their rules, only those who cultivate the royal land have to pay a portion of the gain from it. If they want to go they go, if they want to stay on they stay. The king governs without decapitation or other corporal punishments. Criminals are simply fined. Even in cases of repeated attempts at wicked rebellion, they only have their right hands cut off. Throughout the whole country the people do not kill any living creature, nor drink intoxicating liquor, nor eat onions or garlic. The only exception is that of the Chandâlas.² That is the name for wicked men who live apart from others. . . . In that country they do not keep pigs and fowls, and do not sell live cattle; in the markets there are no butchers' shops, and no dealers in intoxicating drink. In buying and selling commodities they use cowries (shells). Only the Chandâlas are fishermen and hunters, and sell flesh-meat." He then refers to a custom which prevailed in the country, both long before and long after his time. The potentates of India, like those of Europe in the Middle Ages, were in the habit of making grants of lands, houses, and gardens for the maintenance of monastic establishments, in order that the monks might be able, without let or hindrance, to attend to the duties of their calling, which, as specified by Fâ-hien, were to perform acts of meritorious virtue, to recite their Scriptures, to sit wrapt in meditation, and to receive and entertain stranger monks in every respect as the law directed. The deeds of gift conveying these grants were generally inscribed on plates of metal. Not a few of such plates have, in recent times, been discovered and deciphered, and scholars have found them useful chiefly in throwing light upon questions of Indian chronology, a subject which the Sanskrit writers neglected as much as history itself.

From Muttra the pilgrims proceeded south-east for 18 yojanas,³ and found themselves in a kingdom called Sankâsya, the name of which still remains in Samkassam, a village 45 miles north-west of

¹ It is the Modoura of Ptolemy, who calls it the "City of the Gods."

² Chandâla is the generic name for a man of the lowest and most despised of the mixed tribes, born from a Sudra father and a Brahman mother.

³ The yojana is an Indian measure of distance, varying like the Persian parasang, or the mile in some parts of Scotland, in respect of the length which it indicates, from 4 or 5 to 8 or 9 English miles. In Fâ-hien it is about 7 miles.

Canouj. This is the place where Buddha is said to have come down to earth, after having been in heaven for three months, preaching his law for the benefit of his mother, who had died seven days after his birth. At one of the Sankâsya topes there were about a thousand monks and nuns, who all received their food from a common store, and were adherents, some of the Great, and some of the Little Vehicle. Fâ-hien remarks that the country here was very productive, and that the people were beyond comparison prosperous and happy. The next halting-place was Canouj—a city of great celebrity in early Indian history, situated on the banks of the Kalinadi, a branch of the river Ganges. Its name is a contracted form of Kanya-Kubja, a Sanskrit compound, which means *the city of the hump-backed maidens*, and has reference to a legend concerning the hundred daughters of one of its kings, who were made deformed under the curse of a rishi, whose overtures they rejected. Here Buddha was said to have preached on such themes as the bitterness and vanity, the impermanency and the uncertainty of life, and the nature of the body, which he compared to a bubble or foam on the water.

On leaving Canouj, the pilgrims came successively to A-le (which has not been clearly identified), then to the kingdom of Shâ-khe, that is, Saket, the Sagôda of Ptolemy, and then to Srâvasti in Kosâla—the pristine kingdom of the Solar race. The city has long since vanished, but the ruins of it have been discovered on the south bank of the river Rapti, about fifty-eight miles to the north of Ayodya or Oude, i.e. of Faizabad. In one of the suburbs of Srâvasti was the vihâra of Jetavana, celebrated for the beauty of the gardens by which it was surrounded, and held especially sacred as having been for twenty-five years the residence of Sâkya-muni himself, after he had obtained the Buddhahship, that is, enlightenment or perfect wisdom. This vihâra, which consisted originally of seven stories, continually attracted to it the kings and people of the countries around, who vied with each other in their offerings, which consisted of flags, canopies, flowers, incense, and lamps, which by their multitude made the night as bright as day. The pilgrim mentions several places in this neighbourhood which he visited, as being famous in the history of Buddha and his immediate disciples. He then came to Buddha's birthplace, the city of Kapilavastu. "Here," he says, "there was neither king nor people. All was mound and desolation—of inhabitants there were only some monks, and a score or two of families of the common people. The country is a great scene of empty desolation. The inhabitants are few and far between. On the roads people have to be on their guard against white elephants and lions,¹ and should not travel incautiously." The site of Kapilavastu, which was destroyed in Buddha's lifetime, is a short distance north-west of Goruckpore, latitude 26° 46' N., longitude 83° 19' E.

¹ He does not say that he saw these animals, otherwise his veracity might be called in question.

On leaving it the pilgrims journeyed eastward, and after halting at Râma or Râmagrama, and other two places with noted topes, reached the Medina of Buddhism, Kusânagara, "on the north of which, between two trees, on the banks of the Nairanjana River, is the place where the World-honoured One, with his head to the north, attained to *Pari-nirvâna*, and died." They found the inhabitants of the city to be but few and far between, and to consist only of the families belonging to the different societies of monks. The ruins of Kusânagara are still extant, near Kusiah, one hundred and eighty miles north-west from Patna, and eighty miles due east of Kapilâvastu. On leaving this place, and travelling twenty-two *yojanas* to the south-east, the pilgrims reached the kingdom of Vaisâli, the Passala of Ptolemy, in the capital of which the second great council of Buddhism had been held. This kingdom, which was of no great extent, stretched northward from the Ganges, along the banks of the river Gandak. Its capital, called also Vaisâli, was situated at some distance from Hâjipur, a station near the junction of these two rivers, and distant about twenty miles from Patna, which is reached by crossing the Ganges. The pilgrims, having crossed the river, and descended south for a *yojana*, came to the town of Palin-fou, that is Pataliputra, now Patna. "This," says Fa-hien, "is the city where Asôka resided, who reigned over the kingdom of Magadha. The royal palace and hall in the midst of the city, which exist now as of old, were all made by genie which he employed, and which piled up the stones, reared the walls and gates, and executed the elegant carving and inlaid sculpture-work, in a way which no human hands of this world could accomplish." From this, and the rest of his description of the place, Pataliputra would appear to have been the most important and most magnificent of all the cities which he saw in India. He speaks with admiration of its monasteries, temples, topes, hospitals, and schools of learning, and describes the inhabitants as rich and prosperous, as striving to outvie each other in the practice of benevolence and righteousness, and as living together in peace and harmony, though professing differing creeds—some being Brahmans, and others Buddhists, both of the Great and the Little Vehicle. The prosperity of the city was no doubt owing mainly to its advantageous situation at the confluence of the two great rivers, the Ganges and the Sôn,¹ which made it a great centre of commerce. Fa-hien's account of the greatness and splendour of the city, shows that it had undergone no deterioration in these respects since the days of Megasthenes, whose description of it we may here quote: "Palibothra is in length 80 stadia (10 miles), and in breadth 15 (2 miles nearly). It is in the shape of a parallelogram, surrounded by a wooden wall, pierced with openings, through which arrows may be discharged. This wall has 570 gates and 64 towers. In front is a ditch, 600 feet in width, and 45 in depth, which serves the purpose of

¹ The Sôn, with the caprice for which Indian rivers are notable, has changed its former course, and now joins the Ganges 16 miles above Patna.

defence and of a sewer for the city." In another passage he ascribes the foundation of it to Hercules, "who built therein," he says, "many sumptuous palaces, and settled within its walls a numerous population." Though the greatest of the Gangetic cities of those days, it was by no means the most ancient, as it was not founded till after Buddha's death, the date of which is 543 B.C. It was visited by Hiouen-Tsang, about 230 years later than by our pilgrim. By that time all its glory had departed, we know not how, and it had shrunk from the dimensions of a great metropolis to those of a paltry village; for Hiouen-Tsang saw upon its site nothing but heaps of ruins, and some two or three hundred houses of the meanest description. But even the ruins which he saw have long since disappeared. They lie buried to the depth of more than a dozen feet below the foundations of the modern city of Patna,¹ which is, perhaps as large and populous as its predecessor, but far from being distinguished, as it was, for the superhuman magnificence of its architecture.

The country extending southward from Pataliputra to the city of Gaya, which is about 60 miles distant, may be regarded as the Holy Land of Buddhism. Here its great founder had spent not a few years of his life; had wandered over its hills, and by the margin of its streams; had sat upon its rocks, and under the shade of its trees; had meditated in its caves, and amid the depths of its forests; and here—all the while teaching and preaching his law, making converts, and working miracles without number—he had, after practising with himself the most painful austerities, and resisting the strongest temptations, finally attained to perfect wisdom. At the various places which he had consecrated by his presence, commemorative topes had been reared, and monasteries founded, which even to the present day are resorted to by throngs of pilgrims. Fā-hien, as might be expected, visited all these notable localities, and never fails to recount the legends connected with them, at which, however extreme may have been their absurdity, his faith never staggered. He returned from Gaya to Pataliputra, whence he proceeded westward along the course of the Ganges, till he came to the city of Vārānasi, in the kingdom of Kāśi. Vārānasi is the modern Benares, well known as the holiest seat in all India of Brahmanism. From Benares, he returned to Pataliputra, where he remained for three years, occupied in the manner which has already been noticed. From this he proceeded, now left without a companion, along the course of the Ganges to Tāmalipti or Tamluk, which was then the greatest emporium of commerce in the Gangetic Delta. From Tamluk he proceeded by sea to Ceylon, as has been already stated, and it does not fall within our purpose to trace the pilgrim's progress any further. We shall conclude by quoting the well-deserved eulogium written regarding these Chinese pilgrims by Mr Beal: "Never did more devoted pilgrims leave their native country

¹ About ten years ago, when a tank was being dug in Patna, a portion of the wooden wall, mouths of wells, and fragments of earthen vessels, were discovered at a depth of some 12 or 15 feet below the surface.

to encounter the perils of travel in foreign and distant lands; never did disciples more ardently desire to gaze on the sacred vestiges of their religion; never did men endure greater sufferings by desert, mountain, and sea, than those simple-minded, earnest Buddhist priests."

NOTES ON PLACE-NAMES OF IONA.

[The Paper in our *August* number on *The Place-Names of Iona*, by Mr. Alexander Carmichael, having attracted considerable attention, was submitted to the eminent scholar and ethnologist, Mr. Hector Maclean, who contributes the following valuable Notes.]

Aoi, s. f., a place, a region, a country, an island.—(*O'Reilly*.)

Aoi, a place, a region, an island.—(*M'Leod and Dewar*.)

"Hi, nom. pr. Iova, commonly called Iona; the adj. means 'low.'"—*Stokes' Goidelica*. "Columcille 7 Drostan mac cósgreg adalta tangator ahi marroalseg dia dójb goníc abbordobóir," "Columcille and Drostan, son of Cosgrach, his pupil, came from Hi (Iona), as God had shown to them, unto Aberdour." Quoted from the *Book of Deir* in *Stokes' Goidelica*, p. 108.

"I, íseal, low." Irish-English Dictionary in *Llwyd's Archæologia Britannica*.

In Adamnan's *Vita Columbæ*, the name for Iona is Ioua and Insula Ioua. Formerly there was no difference made in Latin between the *u* vowel and the *u* consonant, so the name was written since Adamnan's time Iova. The Latin *v* was anciently pronounced *w*; therefore the word might be written Iowa, pronounced Eeowa. As our language, as well as other languages, has changed very much in twelve centuries, the change from Ioua to Aoi, and even to I, is not very considerable. Compare old Gaelic *aoi*, a sheep, and the Latin *ovis*, having the same meaning. The *n* of Iona has evidently replaced *u* by a misprint, and it has been retained because Iona is a more euphonious name. Such is also the case with Hebrides, which was at first a misprint for Hebudes. It is amusing to find names improved by blunders.

The oldest Gaelic form of Calum Cille is Columb Cille, which shows clearly that the first part of the name is derived from the Latin *columba*; whence Gaelic *colum*, a dove, and its diminutive *colman* or *calman*, a little or young dove, which now means dove in general. *Amra Choluimb Chille* is the title of a poem composed to St. Columba after his death, by Dallan Forgaill, who was the saint's contemporary, but survived him. *Cill* is shown also by Celtic scholars to be derived from the Latin *cella*. It is surprising that a word of Latin origin, *calman*, has superseded all the vernacular names for dove; no doubt this is to be ascribed to the veneration in which St. Columba was held by the Gaels. *Fearán*, a quoisht or ringdove, *Fearán-breac*, a turtle.—*Ll. Ar. Br.*

Ioua is a feminine adjective derived from an original *Iou*. The form

Hii, found in various writers, suggests a Gaelic form Haoi—the first *i* like *i* in sit, and the second like *ee* in feet; and as this form is used by Bede, he would likely represent the sound of *ao* by the short English sound of *i*, and the second by the longer sound, which in Bede's time was equivalent to *ee*; also *Ii*, and *Hii* are found in the *Saxon Chronicle*. There would be in the olden times, as now, different pronunciations of the same word corresponding to different localities; *I* is but an attenuated form of *Aoi*. *Insula Ioua* may be translated into the Gaelic *Inis Aoidheach*, and *Iona* is occasionally called *Eilean I*.

“*AI*, a region, tract, country, territory, patrimony, inheritance.”—(*O'Reilly*.)

“*AI*, a region, territory.”—(*M'Leod and Dewar*.)

UIDH, a ford, the part of a stream which leaves a lake before breaking into a current. All these preceding words appear to be cognate. *Aoi*, denoting an isthmus joining a peninsula to its mainland, would seem to be the primitive meaning. By extension of meaning it would apply to both the peninsula and the mainland tract connected by it, and then it would come to signify region, district, or country. When such a tract would come into the possession of one lord, then the word would come to mean inheritance. A low isthmus is analogous to a short shallow sound, and so is the sheet of water, *uidh*, that joins the lake to the stream. *Tairheart*—although boats were drawn across necks of land so called—has nothing to do with *bàta*. The word is derived from *tar*, across, and *beir*, to bear; that which crosses over between two portions of land. It is really more connected with the passenger that crosses by land from the one district to the other, than with the hauling across of boats. *Caol I* is evidently *Caol Aoi*, and has either succeeded an *Aoi*, or has been so called analogically. *Inis-Cat* is an interesting name.¹ Without assuming that these isles were at one time connected with the mainland and the centre of an extensive country, how is it possible to account for the huge cairn on the side of a hill in North Uist, and of the vast monolithic remains in Lewis? *Cataibh*, not *Cataobh* or *Cat-thaobh*. *Cataibh* is the locative plural of *Catach*, and signifies in the *Cattaich* or *Catti*. *Gallaobh* is properly *Gallaibh*, the locative plural of *Gall*, a “foreign settler,” and signifies “in *Guill*, or *Foreign settlers*.” The locative of a people's name was used by the old Gaels for the territory inhabited by the people. *Ulaidh*, Ulster, is the name of a people in the nominative plural; the genitive plural is *Uladh*, and the locative plural is *Ullaibh*, “in Ultonians.” “In Leinster” is, in old Gaelic, in *Laignibh*, in *Lagenians*; the nominative plural is *Laighin*, the genitive of which is *Laighean*. *Connaught* is *Connachta*, which means descendants of *Conn*; the locative is *Connachtaibh*; “in Connaught” is expressed by in *Connachtaibh*, in *Connacians*. So three of the Irish provinces have derived their names from the names of the peoples that inhabited them. There is no pure Gaelic

¹ *Inis* is older and better spelling than *Innis*. *Innis* means to tell.

is any more than there is a pure Gaelic *aig*; both suffixes are modifications of the Norse *vic* and *ness*. Some scholars derive even the first part of Caithness from a Norse word, but I am disposed to believe that it is the Pictish Cait, which comprehended both Sutherland and Caithness.

FAOGHAIL—in M'Leod and Dewar's Dict. *Faodhail*, in which *Gaothar* occurs for *gadhar*: *ao* is always long, and the short sound corresponding to it is that of *a* in *bagh*, *dragh*, *cladh*, etc. The word might correctly be written *faghail* or *fadhail*. The short *a* in Sanskrit has the same sound. The name of Loch Foyle in Gaelic is *Loch Feabhail*, pronounced *fayill*. (See Gaelic part of Dean of Lismore's Book, pp. 42, 43.) *Feabhail* would seem to be composed of *fo*, "under," and *buail*, "water." *Feabhail*, then, is equivalent to *Fo-bhuail*, "under water." Now, when those fords ebb and dry, there is a stream below which does not dry, over which the kind natives sometimes carry strangers on their backs. No doubt Loch Foyle abounds in such streams. *Feabhail*, then, would appear to be the proper spelling of *Faodhail*. *Caip*, foam, feminine, is more akin to the Irish *coip*, also feminine, than to the Scotch Gaelic *cop*, which is masculine.

CLADH-NAN-DRUINEACH, more correctly *Cladh nan Druinneach*, does not mean "burial-ground of the Druids," but "burial-ground of the artists."

Druinneach, an artist.—(Lluyd's *Ar. Br.*)

Druineach, an artist, embroiderer. *Druin*, needle-work, embroidery.—(O'Reilly.)

In M'Leod and Dewar's Dictionary we find "*Druinneach*, a Druid. More properly, *Druidhneach*." So here a word is coined to make illiterate confusion of *druiddh* with *druinneach* rational. The Highland lexicographers of the eighteenth century preferred to follow their own whims rather than put themselves to the trouble of getting knowledge from Edward Lluyd's great work, to which they had easy access. Really we are in need of new Gaelic dictionaries, or else of new editions of those we have. There is an *Eilean nan Druinneach* on Loch Awe, where gravestone sculptors resided and carried on their work, and there are several place-names in which this word is found. There are good grounds, therefore, for inferring that *Cladh nan Druinneach* in Iona is the burying-ground of gravestone sculptors residing there.

KNOC AINGIL.—In Islay there is *Unoc Angail*, where fires were lighted to give light to vessels coming into Lochindaal in olden times. *Angail*, in this case, is a corruption of *Aingil*, genitive of *aingéal*, light. "Aingéal, sunshine, light."—(*Ar. Br.*) "Aingéal, fire, light, sunshine."—(O'Reilly.) The same definition is given by M'Leod and Dewar. *Ainneal*, a common fire, is seemingly derived from *aingéal*. *Ain-i-solas*=*Ain*, that is, light."—(O'Davoren's *Old Irish Glossary*.) *Aingéal* would appear to be formed from *ain*, light, and *geal*, clear or bright. So, in this respect, it signifies, literally, "bright light." *Unoc-na-nAingel*, mentioned in the Introduction to Dr. Reeves's *Life of St. Columba*, and identified with Adamnan's *Colliculus Angelorum*, may have been, previous to the time of St. Columba, not the Hill of the Angels, but the Hill of the Bright

Lights or Fires. The cairn and the small circle would not now be considered Druidical, as in the time of Pennant. Such circles are now ascertained to be ancient and pre-Christian burial-places. The name would likely have been converted to a Christian purpose by the followers of St. Columba by giving it another meaning. *The ghosts of those buried in the mound resided there, and made themselves occasionally visible to the material eyes of those who yet dwell in material bodies!* The name *Sithean Mor* tells that the pre-Christian superstition that still covers the whole of Siberia, Tartary, Thibet, and China has survived St. Columba and his followers. "The natives took their horses at the feast of St. Michael, and coursed round it,"—no doubt to honour the dead buried there. Has the mound never been opened to see whether the bodies were cremated or not?

The old form of Ulaidh is *Ulaid*, "Ulstermen."

"The meaning appears to be *barbati*, cf. *Skr. pula* 'horripilation.' In Gaulish we seem to have it in the tribe name *Tri-ulatti*, Plin. iii. 20, 24, where *tri* is an intensive prefix, and *ubatti* a mistake for *ulati* (*utāti*?)" *Dr. Whitley Stokes on the Celtic Declension, Transactions of the Philological Society*, 1885-6, p. 102.

From this note it appears that *Ulaidh* or *Ulaid*, Ultomans, signifies "Bearded Men." Gaelic *Ula*, a beard.—(*M'Leod and Dewar*.)

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

THE Opening Meeting of the Dundee Branch of the Society was held in the Kinnaird Hall, on the 7th December 1886—Principal Donaldson presiding. Dr. Robert W. Felkin delivered an address on "The Egyptian Equatorial Provinces, and the Relief of the Beleaguered Garrisons." After a vote of thanks had been passed to Dr. Felkin, Principal Peterson, the Convener of the Branch, proposed the following Resolution:—"That this meeting, having heard of the present position of Dr. Emin Bey in the Egyptian Equatorial Provinces, and the reasons which urgently call for his support, is of opinion that means should now be employed by Her Majesty's Government to fulfil the obligations under which they rest towards Dr. Emin Bey and his beleaguered garrisons; and that the Chairman be requested to forward this Resolution to Her Majesty's Principal Secretary of State for Foreign Affairs." This Resolution, having been seconded by the Rev. Colin Campbell, was unanimously adopted by the meeting.

An Ordinary Meeting of the Society was held in the Freemasons' Hall, Edinburgh, on December 1st—Dr. George Smith, C.I.E., Member of Council, presiding. Prince Kropotkin delivered a lecture on "Siberia's Tablelands, Mountains, Plains, and Tundras," which will be published in a subsequent number of the *Magazine*. A vote of thanks was passed to Prince Kropotkin, on the motion of Mr. Will. C. Smith, Advocate.

GEOGRAPHICAL NOTES.

EUROPE.

Government Neglect of Science in Scotland.—The 104th session of the Royal Society of Edinburgh was opened on 6th December by an address from Mr. John Murray, of the *Challenger*, one of the Vice-presidents. The address contained many points of great interest to other Societies in Scotland, and remarks upon Government endowment of geographical and meteorological research which it is desirable to make widely known. The following is a condensed report of the address :—

The membership of the Royal Society numbers 507,—about the strength of the Royal Society of London. The publications of the Society have increased in size and value, and those for the current session will include two special volumes of great importance, one on the Botany of Sokotra, the other containing a complete record of the Ben Nevis Meteorological Observations. The valuable and ever-increasing library of the Society now contains 20,000 volumes, chiefly acquired by exchanges with other Societies at home and in all countries. The space at the Society's disposal is utterly inadequate for the proper arrangement of the library, and reference to many of the volumes is difficult, and to some impossible. The Council has laid before the Board of Manufactures a statement of the strong claims of the library to increased accommodation when the removal of the Antiquarian Museum will provide more space in the building. The value to an investigator of being able readily to consult the memoirs of other Societies, and so rapidly gain all existing information on the subject he is studying, cannot be over-estimated. To the existence and completeness of our library we owe the presence in Edinburgh of the office of the *Challenger* Commission, which has been the means of attracting many foreign *savants* to the city, and both directly and indirectly stimulating the public interest in many branches of science and exploration.

A Society like ours has a very special interest in seeing a truly complete national library established in Scotland, for to scientific and literary men such a library is the most important instrument of research. There is a great wealth of libraries in Edinburgh, but want of room and restrictions as to access make reference to the works in some of them—*e.g.* the Advocates'—a very irksome matter. There is a popular belief that the Advocates' Library contains every English book. As a matter of fact, it is very defective in the literature of some periods ; it lacks many important provincial publications, and is, of course, very deficient in Indian, Colonial, and American works, which are every year becoming more important. There are relatively few foreign works in the Advocates' Library, and were it not for the excellent series of foreign treatises in the University Library, Edinburgh would be very poorly supplied in this respect. If we wish to consult all the authorities who have described the ice of the Antarctic regions, we can only find some of the books in Edinburgh. If we wish to consult the original authorities who have described the desert of Sahara, we can find only one or two of them in the city, and gaps like these are not confined to scientific and geographical works. It would be well if there were some central Board in Edinburgh to prevent the unnecessary reduplication of books in different libraries, to suggest what works should be procured to complete deficiencies, and to facilitate access for purposes of scientific research to all libraries. This is in some cases so troublesome that books may be got more easily from some of the learned Societies in London than

from Edinburgh libraries. When we reflect on the great sums spent by Government on libraries in London, and remember that, in addition to the cost of building and maintenance, about £18,000 has been spent during the past ten years on salaries and the purchase of books for the National Library in Dublin, then surely the claims of Scotland deserve some consideration.

Some time ago the Council of the Royal Society drew the attention of the Government to the fact that no bathymetrical survey of the Scottish fresh-water lochs existed, except those of Loch Lomond and Loch Awe; urged the importance in many branches of scientific inquiry of knowing the depth and form of such basins as Lochs Morar, Maree, Lochy, Assynt, Tay, Ericht, with many others; and expressed the hope that these surveys would be undertaken at an early date, and at all events before the completion of the Ordnance Survey of the country. The reply from the Treasury was that these surveys could not be sanctioned, because they did not come within the functions of the Board of Admiralty or of the Survey Department of the Office of Works. This matter was subsequently brought up in Parliament by Lord Balfour of Burleigh, but no steps seem to have been taken to carry out the survey. It may be hoped that this matter will not be allowed to drop. Quite recently, Mr. J. Y. Buchanan obtained a sounding of 180 fathoms in Loch Morar. This is the greatest depth that has hitherto been found on the plateau on which the British Islands are situated; to get equal depths we must go towards the deep gut off the coast of Norway, or beyond the hundred-fathom line off the west of Ireland. There are also geological and biological problems of great interest in connection with the depths of these lochs. Should these surveys not be undertaken, a very important part of the survey of the United Kingdom will be left untouched; for it cannot be denied that it is at least as important—sometimes much more important—to know the depth of a lake as to know the height of an adjoining mountain.

The Council of the Royal Society has recently had before it the subject of Antarctic Exploration, and has drawn up and printed a number of suggestions as to the investigations which should be undertaken or attempted by such an expedition. The Antarctic Region appears to exert a controlling influence on atmospheric and oceanic circulation, and it presents interesting problems in almost every branch of science. No steam-vessel, protected for ice, has yet penetrated those seas, and although there will be some risk in endeavouring to pass the winter amongst the unknown severities of the southern ice, the attempt must be made, and the duty of making it lies more on Great Britain than on any other nation. If Great Britain is to maintain her position amongst the nations, she must explore the Antarctic, and it is to be hoped that the numerous learned Societies of the United Kingdom will before long press the matter on the attention of Her Majesty's Government.

During the past few years there has been great activity in the examination of the biological conditions of the coasts, lochs, and estuaries of Scotland. The Scottish Marine Station has nearly completed three years' observations on the Firth of Forth and one year's on the Firth of Clyde; results of much interest to Meteorologists having been ascertained.

In the Ben Nevis Observatory the Fellows have a special interest, for the Observatory buildings and the road thereto are the property of the Royal Society of Edinburgh, and the Society has in many ways assisted the work of the observers. Ben Nevis was selected as a site for the Observatory not only because it is the highest point in Great Britain, but because it stands in the very track of the prevailing south-westerly winds from the Atlantic, and it is so near the sea that a sea-level station, 4406 feet below the Observatory, is only four miles

from the summit. Continuous observations every hour at the high level, and five times a day at the low level, have now been made for three years, and all the results are embodied in the forthcoming volume of the *Transactions of the Royal Society*. The climatic difficulties were great, but they have been successfully surmounted by the skill of the architect, Mr. Sydney Mitchell, who constructed the buildings, and by the endurance, and fertility and readiness of resource, displayed by Mr. Omond and his staff of assistants in meeting emergencies as they arose. All the recorded readings from Ben Nevis are made by direct observation—not as in many, if not most, observatories, mainly by self-recording instruments; and from the peculiar conditions of such a high-level station, it appears that the time will never come when such self-denying services as are now being rendered to science by Mr. Omond can be dispensed with. High expectations were entertained as to the value of the Ben Nevis work, and in every way these have been more than realised. Amongst other things, the rate of decrease of temperature and of atmospheric pressure with height have been more correctly determined, important hygrometrical researches have been carried out, and information of great value for forecasting the weather has been obtained. The erection and maintenance of the Observatory have cost £7000, which was derived solely from private subscriptions and from learned Societies. The directors have to pay the Post-Office Department of Government £133 per annum as rental for the telegraph wire from Fort-William to the top of the mountain. The Post-Office has moreover received over £100 for tourists' messages transmitted by the observers, and the daily despatch of press messages is a considerable source of income to that department.

The annual Government Grant of £15,300 for meteorology is administered by the Meteorological Council, a committee of the Royal Society of London, and from it £100 is given to Ben Nevis—in return for a complete copy of all the observations, for the mere clerk-work of which the grant scarcely pays. All other assistance by Government has been refused; and until Mr. Buchan's discussion of the meteorology of Ben Nevis is completed, the Meteorological Council decline to use the observations to aid in framing forecasts, nor will they assist the discussion of the data by means of a grant. Some of the directors have more than once placed considerable sums in the bank to the credit of the Observatory, to enable the work to go on without a break. It has been resolved to make another appeal to Government to grant aid to this unique enterprise of national importance. Money grants of considerable annual value are devoted to the maintenance of learned Societies in London and Dublin. In Scotland the only grant of the kind is £300 annually to the Royal Society of Edinburgh, and this is repaid to a Government Department in the form of rent!

One might well ask what Scotland has done that her learned Societies and scientific men are treated so niggardly as compared with those in England and Ireland. It is sometimes said that in literary matters Scotland, and especially Edinburgh, is a mere shadow of her former self: but in science this is not the case, and it is towards scientific matters that the great ploughshare of human thought and activity is in this age directed. "I question," said Mr. Murray, "if any country in the world, taking its size into consideration, can show a better record of scientific work or a greater mass of scientific literature than Scotland during the past ten or twenty years. The Council are strongly of opinion that a portion of the annual grant of £4000 should be administered in Scotland, and it is about to approach Government on this matter. Our Society claims the right to memorialise the Government on scientific affairs which it considers of national importance; and in purely Scottish matters, it

holds that its President and Council, and not the President and Council of the Royal Society of London, are the proper advisers.

"In the attempt which the Council is now about to make, I would bespeak the co-operation and support of all Scotsmen who believe it to be for the honour and well-being of the country that our scientific institutions should not languish or our scientific men be discouraged, but that both should be urged to new advances and greater conquests."

The Clyde Sea-Area in December.—The physical conditions of the Clyde waters have been investigated by the Scottish Marine Station during the greater part of last year. The sixth tour of the region, including Loch Lomond, was completed by Mr. Murray and Dr. Mill on 31st ultimo. By means of more than forty serial temperature soundings, the distribution of warmth was ascertained, and some interesting conclusions may be drawn from the results. Considerable delay was caused, and plans had repeatedly to be changed, on account of the uncertain nature of the weather. There were very good samples of all kinds—clear, calm days, without a breath of wind; thick fog; warm south-westerly gales, with a bright dry sky; and squalls of cold rain and sleet from the north-east—all in close succession. In consequence of these changes, surface temperature was subject to considerable fluctuations; but omitting the first two fathoms, the distribution of warmth was probably not affected throughout the mass of water in any abnormal way. The mean temperature of the air for the hours of observation was $39^{\circ}0$ F. with the dry-bulb, and $37^{\circ}8$ with the wet-bulb thermometer.

Loch Lomond has been cooling rapidly since November. The shallow Balloch Basin has fallen nearly 8° , the temperature on December 20th being $38^{\circ}3$ at the surface and $39^{\circ}3$ at the bottom. A few days later this part of the loch was covered with ice. The deeper Luss Basin had a uniform temperature throughout its 30 fathoms of $42^{\circ}5$, a fall of $5^{\circ}5$ in a month; and the very deep water (100 fathoms) of the Tarbet Basin, instead of decreasing in temperature from $47^{\circ}3$ at the surface to $41^{\circ}6$ on the bottom, as it did in November, only varied from $42^{\circ}9$ to $41^{\circ}9$. On crossing the narrow isthmus at Tarbet to Loch Long, the great difference produced by free access of tidal water became apparent; but it will be necessary in this note to deal generally with the sea-lochs and deep basins, not to describe each in detail.

The greatest amount of cooling had taken place in the shallow lochs and the open basins, where the temperatures were from 4° to 5° lower throughout the whole mass of water than they were in November. The cooling was, on the whole, slightly greater at the bottom than at the surface, the result being that the deep water is not now so much warmer than the superficial layers as it was a month ago. On the plateau, where the distribution of warmth is always nearly uniform, it was 4° colder throughout, the temperature being now about 45° . The warmest water met with was, as usual, that in the Irish Channel; where, in 40 fathoms, the surface and bottom temperatures were respectively $48^{\circ}2$ and $48^{\circ}5$ on Christmas Day. The weather during November had been too rough to admit of observations being made there; but in September $54^{\circ}7$ was the average from surface to bottom.

The deep enclosed lochs were most interesting. In Loch Goil the bottom water at the deepest part is now warmer than it has been during the year; in November it was $45^{\circ}7$, in December $47^{\circ}6$, an increase of almost 2° . It is not yet ascertained whether it is by conduction or by convection that the summer heat travels so slowly towards the bottom, while the upper layers are rapidly

cooling by winter cold. Since the deep open basins have been, notwithstanding their much greater depth, falling in temperature for two months past throughout their entire extent, it is evident that the bar which shuts off the deep loch-troughs from communication with the outer waters is the proximate cause of the slower transmission of heat downwards. In the deepest part of Loch Fyne, off Strachur, the bottom temperature was $44^{\circ}7$ in December, in June it was $44^{\circ}2$; and this change of half a degree is the whole effect of all the subsequent summer on that part of the loch. Since the temperature there was $41^{\circ}8$ in April, a sudden descent of winter cold may be looked for within the next few months. It was impossible to extend observations to the head of Loch Fyne, because on December 30th a uniform sheet of ice, nearly half an inch thick, covered the entire loch from a point about three miles to the south-west of Dunderave onwards. The sound of the vessel crashing through this thin ice was most extraordinary; and the sight of the uniform covering rising and falling on either side as the waves from the propeller swept under it gave a vivid idea of the elasticity of this substance, usually considered the very symbol of brittleness. Though thin, the ice was so sharp that it would have been dangerous to the *Medusa's* timbers to have forced her through it for any distance. The remarkable thing was that two inches beneath the ice the temperature was 36° , and six inches beneath it 41° , while on the bottom there was a higher temperature than had been there since last winter. The formation of ice was almost certainly due to the fresh water poured down by the rivers and mountain burns almost at the freezing point, and spread in a thin layer over the denser salt water.

The distribution of temperature in the Clyde sea-area is now that of uniform increase from surface to bottom, except in Loch Fyne and Loch Goil, where the maximum occurs before the bottom is reached, and where, consequently, the summer condition of decreasing temperature with increasing depth still continues.

The complete series of observations made on the Clyde by the Scottish Marine Station are published in the last number of the Scottish Meteorological Society's *Journal*, and it is intended that such observations should be continued for at least another year.

Journey across Iceland.—Dr. Labonne writes from Akreyri, in the north of Iceland, 26th August 1886:—"I have just crossed the island from south to north by the central desert or Sprengisandr, without taking either tent or provisions with me. I am certainly the first European who has by practical experience shown the possibility of this feat. On 14th July I ascended Hekla in splendid weather, and had the good fortune to get a clear view of a great part of the south of the island. I could also see distinctly Westmann Islands, at a distance of twenty leagues from the volcanic cone. Except for some small columns of steam rising from narrow fissures, there is nothing to suggest that the volcano is not extinct." Dr. Labonne estimates the height of Hekla (by barometric measurement) to be 5095 feet above sea-level. On the plain the temperature was 14° C.; at the summit the thermometer sank to 8° C. He arrived at the Great Geyser on Saturday evening, July 17th, just in time to witness a magnificent eruption, which threw up its warm-water column to a height of 108 feet. The guide stated that during the past two years the outbursts had been more frequent, and had shot up to a greater height. The traveller spent three days in the "smoking valley," investigating the problem of the former existence of vegetation in the island, for the *Sagas* speak of luxuriant vegetation and even of forests. On examining the silicious deposits formed

around the basins of the geysers, he obtained, $16\frac{1}{2}$ feet below the surface, a large slab containing foliated branches of *Betula alba*, *Salix caprea*, and *S. arctica*. Considering that the geysers deposit their silicious ejecta at the rate of 2 millimètres a year, it must have taken the Great Geyser a period as long as at least the time that has elapsed since the discovery of the island, in 874, to deposit an accumulation 5 mètres deep ($16\frac{1}{2}$ feet). Whenever the ice and icebergs collect together and remain stationary off the north coast of Iceland, as was the case in 1886, and vessels are unable to double North Cape, Continental Europe enjoys a hot summer, but Iceland a cold one. On the contrary, when the ice passes south between Greenland and Iceland, the climate of this last is one of temperate heat, whilst Scotland, and even the northern coasts of France, suffer much from Arctic winds.—*Bull. Soc. de Géogr. de Paris*, No. 16, 1886.

Population of Alsace.—The returns for Alsace of the census taken on the 1st of December last have been only just published. The total population was 1,074,626, being an increase of only 669 on the number five years before. There is an excess of 27,668 females, against a similar excess of 29,757 in 1880. The population of Strasburg was 111,987, being an increase of over 6000 within the five years; Mülhausen, 69,759; Colmar, 26,587; Gebweiler, 12,388. These last three towns are practically stationary. The population of Metz, exclusive of the garrison, was 54,072, being an increase of nearly 1000 within the five years.

A Survey of Russian Poland.—In Dr. Petermann's *Mitteilungen* for November 1886, we learn that the Imperial Russian Geographical Society is planning a comprehensive ethnographical and ethnological survey of Russian Poland. This province has hitherto been much neglected by Russian scientists, and is, according to Professor Petri, not even included in the great "Geographical Statistical Lexicon of the Russian Empire."

Construction of a Canal between the Volga and the Don.—In 1696 Peter the Great attempted to unite these two rivers, and trenches were actually dug. Before him Selim II., son of Soliman the Magnificent, had attempted to do the same thing, when laying siege to Astrakhan about 1563. Since then various Russian engineers have drafted projects with the same end in view; but their proposals have never come to anything. During the summer of 1885 a survey was undertaken by the French engineer, M. Léon Dru, on behalf of the Russian Government. Already more than 930 miles of the country stretching between the two rivers have been explored, and 2408 feet of borings have been made. The results already obtained are sufficient to prove the possibility of traversing the watershed between the Don and the Volga. Locks would have to be constructed on the versants of both rivers. Referred to the standard of the Black Sea, the banks of the Don are as +39, and those of the Volga as 0.0. The course selected for the canal would be $53\frac{1}{2}$ miles long, and renders feasible the creation of an inland port at Krivaya-Muzga, the terminus of the railway line from Griazi—a matter of first-rate importance for the traffic of the interior parts of Russia. The canal will be fed by reservoirs constructed along its course, each capable of holding from forty-five to fifty million cubic mètres of water, as well as by mechanical lifting from the Volga; but this last is not indispensably necessary. The trenches of Peter the Great were discovered 9 miles from Kamichinka in a good state of preservation. At the present time more than 500,000 tons of goods pass annually between the two rivers by road and by rail. It is estimated that the canal would soon carry a traffic of 900,000 tons annually. Although

the execution of the project is acknowledged to be fraught with great difficulties, yet it is decidedly a work of national importance. It will establish a water-way between the Baltic and White Sea on the one hand, and the Black Sea on the other; also between the Caspian and the Black Sea, and so the Mediterranean Sea. By this means the traffic of Asia will get a new outlet, and an easy route will be opened for the transference of military stores, etc., by shipment from Sebastopol to the Caspian for operations in Turkistan. Then, the Don being brought into the general system of river navigation of the empire, torpedo boats can be readily transferred from sea to sea, or concentrated in any one of them, without having to circumnavigate three-quarters of Europe.—*Bull. Soc. de Géogr. de Paris*, No. 16, 1886.

ASIA.

Petroleum in the Caucasus.—*The Coming Deluge of Russian Petroleum and its Bearing on British Trade*, is the title of a pamphlet lately written by Mr. Charles Marvin, and, although somewhat hysterically garnished, it is well worthy of the earnest and immediate attention of British traders. As has been well known for some time, enormous quantities of petroleum have been found with comparatively shallow borings at both the Black Sea and the Caspian ends of the Caucasus range.

At Baku, on the western shore of the Caspian, one well alone spouts out, from an orifice ten inches in diameter, 11,000 tons of petroleum *per diem*, or more than all the other oil-wells of the world and the shale-oil factories of Scotland and New South Wales put together. This, too, it must be noted, is only one well in the midst of hundreds, and there is no sign of drying up. This Baku oil is pronounced by Mr. Redwood, chemist to the London Petroleum Association, to be in some respects superior to the best American refined petroleum.

The great desideratum for the Caspian oil is to get cheap transport for it to the Black Sea. To obtain this, it is proposed to construct a pipe 600 miles long from Baku to a point on the Black Sea. The cost of this pipe is estimated at about £2,000,000; and, as Mr. Marvin points out, the contracts for the construction, and for the various works in connection with it, are well worthy the attention of English capitalists.

In addition to the Caspian supply near Baku, there are enormous oil fields at Ilski, in the neighbourhood of Novo Rassisk, on the Black Sea; and a pipe line 47 miles long, crossing a range of hills, already connects these places.

A most interesting Report, by Colonel C. E. Stewart, on all this oil district, is published as a Supplement to the *London Chamber of Commerce Journal* for November, and all who are interested in the subject should read both this Report and Mr Marvin's pamphlet. It seems impossible to exaggerate the capabilities of these oil fields when they are fairly set agoing. The question is, Who is to control the market—Englishmen or foreigners? Steamers are required to carry the oil in bulk, railways and plant for the opening districts, large engineering works, refineries, etc.; and not only that, but improved petroleum stoves for household use. It is a question worthy the attention of shipbuilders, how far the waste products of petroleum may serve as a substitute for coal in ocean steamers.

We quote the following from Colonel Stewart's Report:—

"Astatki is the Russian name for the petroleum refuse after the benzene, gasoline, and solar oil have been distilled off from the crude petroleum. This astatki, having lost its more volatile particles, has a very high flashing and burning point; its flashing point varying, according to quality, from 316° to 322° F., or even

higher, and its burning point being as high as from 416° to 422° F. It will thus be seen that astatki is not at all a dangerous fuel to carry in steamships for use in marine engines, and the advantages it possesses over coal are very great. Not only is astatki more cleanly than coal, but also it is much more easily stowed on board ship, and requires less room for its stowage than coal. It can be stowed in spaces that could not possibly be available for coal; for instance, between the outer and inner bottom of the ship. There are no cinders or ashes remaining, the combustion being perfect. Where astatki is used, it does away with the necessity for a fire-crew beyond the number required for cleaning the machinery and regulating the steam. Any one who has watched stokers at work in the hold of a coal-burning ship in a hot climate would appreciate the advantages of doing away with all stoking. A vessel can take on board astatki at the rate of 100 tons an hour, as it is pumped on board through a pipe. At least 200 steamers on the Caspian Sea, the Volga river, and a few on the Black Sea burn astatki as fuel; and three lines of railroad—the Zaritzin, Griazi—with its terminus on the Volga; the Trans-Caucasus, from Baku to Batoum; and the Trans-Caspian, from Michaelofsk to Merv—also burn astatki as fuel. A properly arranged astatki furnace is smokeless, and the fires require little or no attention after they have been once lighted."

Recent Physical Observations.—*M. Venukoff*, writing to the Paris Geographical Society, says: Two important results have been added to our knowledge of Physical Geography, thanks to the investigations carried on last year in Asiatic Russia. *M. Nicolsky* has found that the drying-up of Lake Balkhash—that is to say, the continuous decrease of its level—is going on at the rate of 1 metre every fourteen or fifteen years. The southern portion of this vast basin, known under the name of Ala-Kul, is gradually being transformed into a deposit of salt, precisely in the same manner as the Kara Bugas, which forms part of the Caspian Sea. The water there is extremely salt.

Another result, worthy the attention of geographers, is the relative height of the culminating point of the canal that quite recently united the river basins of the Obi and Yenisei. The altitude of this point, which is occupied by Lake Bolshoe, is 19 mètres above the level of the Obi at its junction with the Kiti; while it is 55 mètres in regard to the altitude of the Yenisei at the mouth of the Bolshoe-Kas. As Lake Bolshoe is three times nearer the Yenisei than the Obi, it is evident that the eastern slope of the country traversed by the new navigable waterway is much more rapid than the western slope. But, in general, the three figures above given prove that the country between the two great rivers, the Obi and the Yenisei, under the 59th parallel, is perfectly flat.

M. Potanin.—The *St. Petersburg Oriental Review*, of November 4th, says that *M. Potanin* returned safely on the 22d October to the Siberian frontier town of Kiachta, after an absence of three years, spent in the exploration of Mongolia and China. Throughout his long and difficult journey, *M. Potanin* was accompanied by his wife. The expedition was undertaken by order and at the expense of the Imperial Russian Geographical Society; and the *Oriental Review* says, "We expect the richest and most valuable results from the scientific exploration of China and Mongolia."

AFRICA.

On certain Altitudes in Morocco.—From 5th to 29th May 1877, *M.M. François* and *Desportes* took twenty-five observations with an aneroid barometer at Fez,

which gave a mean atmospheric pressure of 730·56 millimètres; the extremes were 724 and 735 mm. The altitude corresponding to this mean pressure may be estimated at 342 mètres (1122 feet). *M. de Foucauld*, in July 1883, took, in the Jewish quarter, situated in the highest part of Old Fez, 100 observations, which gave an altitude of 400 mètres (1312 feet). In 1885 *M. Duveyrier* took 129 observations in the low part of the New Town, from which the altitude was calculated to be 352 mètres (1155 feet). With respect to the altitudes of the Atlas—in 1830 Washington measured from Morocco a peak which he called Miltzin, and found its height to be 11,401 feet above sea-level. On 14th October *M. de Foucauld* crossed the Atlas by the well-known pass of Glâwi, and determined its altitude at 8530 feet. The grand passes of the Alps—Simplon, Mt. Cenis, St. Gothard, St. Bernard—range in height from 6562 to 8202 feet; and since the peaks of the Moroccan Atlas present contour lines very similar to those of the Alps and the Pyrenees, it may be fairly correct to say that in general the highest summits of the Atlas are about equal to those of the two European chains named. In vol. xii. of the *Annuaire de la Société Météorologique*, *M. E. Renou* showed that the limits of perpetual snow fall at an altitude where the temperature of the warmest half of the year is equal to 0° C. In the centre of the Atlas Mountains this temperature at the sea-level is from 23° to 23°·5. Estimating a decrease of 1° C. for every 165 mètres (541 feet, of altitude in the warm season, this would prove that the limits of perpetual snow on the Atlas should fall at 12,468 feet. According to reports furnished to General Wimpfen, in April 1870, at Wady Guir, travellers crossing the plateau which separates the Ziz from the Guir, and proceeding from Guir to Taflelt, saw mountains covered with snow at 124 miles distance. One can hardly assign a less altitude than 14,765 feet to these summits, the principal of which, according to *M. de Foucauld*, lie in about 30° 30' N. lat., and 4° 39' W. long.—(*M. de Renou*, Director of the Meteorological Observatory of the Parc de Saint-Maur, Paris, in *Bull. de la Soc. Géogr. de Paris*, No. 16, 1886).

M. Duveyrier.—Up to the present all attempts by Europeans to penetrate the Rif, to the north of Morocco, have failed, in consequence of the resistance offered by the native inhabitants. *M. Duveyrier*, the explorer of the Sahara, says *L'Afrique*, has not been more fortunate than his predecessors; he has been obliged to abandon the exploration he hoped to carry out this year. In each attempt he was baffled, but he has made a very exact sketch of his itinerary from the Algerian frontier to Melilla, which will be published by the Paris Geographical Society.

The French in Tunis.—According to Petermann's *Mitteilungen* for November last, Dr. Fischer obtained, during his Tunisian journey in March 1886, a favourable impression of the beneficial character of the French military occupation of Tunis. Dr. Fischer's notes appeared in the *Kölnische Zeitung*, Nos. 300-304 (1886), under the title *Reiseskizzen aus Tunis*. Dr. Fischer obtained evidence in Algeria, however, that the French are not well qualified to understand and influence foreign peoples. As regards Tunis, the French military staff's Geographical Bureau, under Colonel Perrier, has conferred a lasting favour by preparing and publishing an excellent map of Tunis; and, in the eyes of geographers, the five years' occupation of Tunis by the French will have been well spent should this map remain the sole monument of their presence. True, the "Carte de la Tunisie" may not be worthy of comparison with the military staff maps of European States, but the new map will be of immense utility to travellers, and marks a decided progress in our knowledge of Tunis.

Dr. G. A. Fischer's attempt to relieve Dr. Junker.—On 3d August 1885 Dr. Fischer set out from Pangani, on the mainland, opposite Zanzibar, to find out Dr. Junker, who since 1879 had been in the Equatorial Provinces of Africa. Dr. Fischer chose the route through Ubugwe in preference to the ordinary caravan route through Bagamoyo, or that through Masai-land. His first object was to reach Kagehe, on the southern shore of Lake Victoria Nyanza; from there he hoped to carry his caravan across the lake to Uganda. The road along the west shore of Victoria Nyanza was debarred to him, owing to the extortionate tribute exacted by a chieftain of Usinja. In the country of Ungu (Nguru), not far from the coast, there were no streams of running water; water to drink had to be gathered from little pools or ponds. On reaching the border-line of the territory of the Masai, the character of the country underwent a total change. At a height of 2887 feet above sea-level, the hill and dale formation gave place to a gradually ascending flat (or nearly flat) plateau, covered with sparse vegetation. The trees, mostly mimosas and acacias, presented a dwarfed and crippled appearance. There were no running streams; and the only water that could be got was muddy and ill-smelling, and was contained in a few pools, partly dry. The southern Masai did little to impede the progress of the expedition, and were moderate in their demands for tribute. Probably this was largely due to the fact that the warriors were absent on a raid in Ubugwe. In Useguia and Ungu—the regions passed through before reaching Masai-land—corn had been very scarce and difficult to obtain, owing to the famine which had prevailed during the previous year (1884). In Masai-land a murrain was raging amongst the cattle, and consequently the tribe were very unwilling to sell their live stock; but on reaching Irangi (5250 feet above sea-level) Dr. Fischer found provisions not only plentiful but cheap. From Irangi he proposed to reach Usukuma by crossing the desert of Turu; but being unable to procure a guide, and water being scarce along that route, he had to abandon the idea and make a detour to the south. At Uwerewere (4364 feet) Dr. Fischer came into Mr. Stanley's route. The country was still very arid, and water was only obtained with great difficulty. The predominant vegetable forms were 'acacias, mimosas, baobabs, and the African ash (*Myombo*).

Proceeding northwards from Uwerewere the expedition entered the Usuri country. Here there was an abundance of negro corn (durrah) and leguminous fruits; but a very high tribute was exacted, the country being subject to Unyanyembe. In order to reach the land of Usukuma they had to cross the steppe or savannah of the river Wembäre or Mairawa (Muaru), which lies apparently 325 feet *below* the level of Victoria Nyanza. The whole of this district was arid in the extreme; not a speck of green was to be seen anywhere, except the euphorbia hedges surrounding the native villages. A dry east wind blew with great violence, whilst the sun's rays beat down upon the shelterless plain with unmitigated force. In Usukuma the tribute charges were again heavy. This arose from the political constitution of the people. The country is split up into a great number of nearly independent districts, through each of which a passage had to be bought; but, on the other hand, provisions were cheap—a sheep or goat could be got for $1\frac{1}{2}$ yards of white cotton. In order to escape the exactions levied in Usmau, Dr. Fischer followed the course of the Simiu, which contains no running stream, but only scattered pools. Kagehe, on Victoria Nyanza, was reached on 16th November. There the traveller met with Mr. Stokes, of the English Mission, who advised him not to cross the lake into Uganda without first sending to inform the King of his intention. Accordingly he sent a deputation of two men, and awaited their return in

Kagehe. It happened to be the rainy season, and 80 per cent. of the expedition were soon prostrated with fever; the natives of the part even suffered severely. On the 7th January the two men returned. They reported that the King (the Kabaka) had on 31st October massacred Bishop Hannington, together with all his followers, and that he would visit the like fate upon Dr. Fischer and his men. He was also warned not to approach any of the territories subject to Uganda, such as Usinja, Karagwe, Usoga. Nevertheless he resolved to try and skirt the eastern shore of the lake, though with little hope of being able to accomplish his mission.

North of Speke Gulf, in Shashi Land, they found the dry and in part treeless plains swarming with wild animals—zebras, gnus, pallahs (*Epyceros melampus*, *Alcelaphus lichtensteini*), elands (*Oreos derbianus*), and Senegal antelopes (*Damalis senegalensis*), as well as the gazelle (*Gazella granti*) found by Speke in Ugogo. The people—good-natured agricultural and pastoral tribes, who suffer much from the Masai—willingly bartered provisions for white cotton stuffs, wire, and beads, also for spades manufactured in Usukuma. Beyond Shashi it was necessary to have a reliable guide, because the population is much mixed, there being numerous small stocks speaking different languages. The route lay through tall grasses devoid of trodden paths, which, with the streams flowing into the lake, made the march difficult. Then came the populous country of the Kavirondo or Wagaia, which stretches for nearly 70 miles along the eastern side of Victoria Nyanza. These districts are but little wooded; close along the shore indeed they are without trees or undergrowth of any description. Here the dry season lasts six months or longer. Millet is the principal object of cultivation. Cattle are plentiful. Wire and beads (white and light blue) and cowrie shells are the coveted objects of barter; stuffs are rejected with contempt. The people dwelling in the south of Kavirondo opposed the advance of the expedition, which only succeeded in reaching the borders of Kavirondo and Kosova at the third attempt. Kavirondo is joined on the north by the territory Njoro, the capital of which (Ukala; Thomson's Kwa Sundu) is the rendezvous of the Mohammedan caravans. At this place the rains had failed to make their appearance—a frequent occurrence of late years—and the people were suffering from famine. Their cattle, too, had almost entirely perished of the murrain. Moreover, Dr. Fischer's supply of wire and beads was practically exhausted. Under these adverse circumstances he had no alternative except to turn eastwards towards Lake Mbaringo. The line of march led across two parallel ridges, separated by the little valley of the Londau. The ridge, or rather plateau, nearest Ukala is 7546 feet above sea-level, and possesses numerous brooks and patches of woodland; that next lake Mbaringo, called the Kamassia Hills, has not quite the same elevation (6562 feet) and is of a waterless character. The same characteristic marks the entire Njemps part of the lake basin, and continues down the narrow depression leading to Lake Nakuro on the south. This was the route followed by Dr. Fischer, who then proceeded southwards as far as Lake Naivasha, where he struck eastwards across the Aberdare Mountains. The inhabitants of these mountainous districts, called the Kikuyu, evinced a thievish and quarrelsome disposition, but were very willing to barter their abundant supplies of provisions, such as durrah, millet meal, peas, beans, sweet potatoes, yams, bananas for coloured cotton stuffs. After considerable difficulties with the people, in which blood was shed, the expedition continued its way through a dense damp forest of bamboos, where a path had to be cut with the axe, and in which they ascended to a height of 8957 feet. At length, on descending to 3937 feet, the country assumed the arid,

sandy, monotonous appearance with which they were already sufficiently familiar; and the same features characterised all the districts traversed till within about a dozen miles of the coast. The entire journey lasted ten months and a half, from 3d August 1885 to 14th June 1886.—*Petermann's Mittheilungen*, 32 Band, xii.

Anglo-German Treaty: East Coast of Africa.—In reference to the recently concluded treaty between Great Britain and Germany, the *Times* Berlin correspondent, writing under date 11th December, says:—The *Cologne Gazette* hears from a trustworthy source that the recent Conference in London with regard to East Africa has resulted in a complete agreement as to the frontiers of the Sultanate of Zanzibar, as well as in an understanding between England and Germany as to their respective spheres of interest in that part of the world, similar to the *entente* come to by these two States with reference to their purposes of annexation in West Africa, and in the South Sea.

As for the delimitation of the Sultan of Zanzibar's territory, the agreement come to assigns him only a strip of land, extending inwards ten geographical miles from the sea, and in length from the Portuguese frontier at Cape Delgado, in the south, to Kipini, and the mouth of the Ozi river in the north; the Sultan promising to intrust German officials with the administration of customs at two specified ports on this coast-line. The object of this stipulation, it is said, is to secure the transit of German goods to and from the interior from possible chicaneries on the part of the Sultan's servants.

The Sultan of Vitu also, who has been a long time at feud with Zanzibar, but is now under the protection of Germany, is to receive a long-wished-for strip of coast, including the Manda Bay, which is well suited for a harbour; and from this arrangement great advantages are expected by the German Vitu Company, which was recently founded under the presidency of Prince Hohenlohe-Langenbourg. To the northward of Kipini, the Sultan of Zanzibar has been allowed to retain several points in which he has long kept garrisons and levied customs. These places include Kismaju, where Dr. Jühlke was recently murdered in a manner not yet clear. As for the delimitation of the respective spheres of interest of England and Germany in East Africa, the latter power is said to have received the immense territory stretching inland from near the mouth of the Rovuma river, and northwards to and including the Kilima-Njaro Mountains, while England contents herself with reserving proprietary claims to the comparatively small region extending north-east of these hills to the Tana river, with Mombasa as a main point of ingress and egress. The French Government is also said to have assented to this agreement, while the Sultan of Zanzibar, too, has declared that he can do nothing but submit to the restriction of his sovereignty to the narrow strip of coast which will now be all that remains to him of the huge tracts, extending as far as the Great Lakes, to which he formerly laid claim. A glance at the map of Africa will show what a vast field of colonial and commercial enterprise has now fallen to the Germans; but it will be very long indeed, all the same, before the tide of emigration from the Fatherland sets towards the shores of East Africa.

The Galla States south of Abyssinia.—In the tenth number of *Petermann's Mittheilungen*, 1886, there is an interesting account by Herr H. Wichmann on the Galla States to the south of Abyssinia, accompanied by a map on the scale of 1:4,000,000. The writer first gives an account of the difficulties which Italian explorers have encountered during the last ten years in their attempts to reach the sources of the Nile through the Galla States. Notwithstanding the

great enthusiasm and energy they have expended upon this object, they have, until now, been unsuccessful, partly on political grounds, and partly on account of the mistrust of the inhabitants. King Menilek of Shoa has at last conquered the small Galla States to the south of Abyssinia, and made them tributary, and ten formerly independent States have been added to his empire. Captain Cecchi and Engineer G. Chiarini have finally been able to penetrate as far as Kaffa. In this region travelling is now much safer and easier for European explorers, permission having only to be obtained from the King of Shoa, instead of, as was formerly the case, from each petty chieftain as well. It will now be possible for travellers to start from Shoa to explore the districts between the Indian Ocean and the sources of the Nile. We have to thank Captain Cecchi for this result, which is the outcome of his energy, and we have also to thank him for the first thorough exploration of the district as far as Kaffa.

The district to the west of Shoa, as far as Godsheb, is enclosed by a row of high table-lands, which are crossed in places by mountain ranges, and in others are cut through by valleys. In the east, these high table-lands are bounded by the Abyssinian Alps; and we may take it for granted that there is no connection between the Abyssinian mountains in the north and those in Masai-Land, as was once generally supposed to be the case. Cecchi thinks that the Arussi mountains, from 2800 to 3000 mètres high, and running from the north-east to the south-west, have some connection with the Masai mountains, and he considers that they form the watershed between the Nile and the Indian Ocean. This, however, is doubtful, because their waters never flow towards the Nile. Some flow to the Hawash, but most join the Umo or Omo, and the Webi, whose westerly tributaries probably break through the watershed. Cecchi considers that this mountain range is a continuation of the Ittu mountains, which are situated to the west of Harar. The Arussi mountains were seen, from several points on his journey, and, judging from the form of their peaks, it is probable they are of volcanic origin.

The average height, in mètres, of the different sections of the journey may be tabulated as follows:—Soddo Highlands, 2450; Kabienna, 2077; Gibie Valley, 1623; Pass in Boloi Mountains, 2673; High Plains of Chora, 2200; Limmu, 1780; Jimma, 2044; Gera, 2070.

From the Blue Nile the plateau gradually falls towards the south; the districts bordering on it have an average height of 2350 mètres, but Langamara in the south is some 600 mètres lower. After passing through the district in which the Gibie, Didesa, and Godsheb have their origin, there is again a small rise in the altitude of the country—Lieca and Limmu having an average height of 1700 mètres.

The geological formation of the country between Shoa and Kaffa is volcanic. On most of the mountain peaks are craters, some of which are still in good preservation, others being hardly distinguishable. The best-preserved craters are found upon the Jerer, Redda-Gebabi, and Suquala. Between Hawash and Kaffa the rocks are mostly basaltic, and in the districts of Chora and Arussi there are many signs of former volcanic outbursts. Along the whole route no metals were discovered.

The most important rivers are the Hawash, Didesa, Baro, Umo, and Godsheb. The Hawash encircles Shoa in a wide bend; and in the east and south, the river forms the boundary between it and the Galla States; it does not reach the sea, but is lost to the west of Tajurrah Bay. All the streams to the south of the Soddo plateau belong to the water-system of the Gibie. According to Cecchi, the Umo is not a tributary of the Nile—as some geographers have

thought—but really forms the upper waters of the river Jub; he believes that the Waira also belongs to the Jub river-system; but it is more probable that it forms the upper waters of the Webi. The other two principal rivers in the Galla States belong to the Nile system. Cecchi also says that the Baro flows to the river Sobat.

The climatological conditions of the Galla States are not particularly good: on account of the altitude, the climate is very moist. The rainy season is a long one, from June till November, and during the rest of the year, heavy rain-storms often occur. The land is very fertile, and, notwithstanding the damp climate, Cecchi is of opinion that, with due precaution, Europeans could live there for a considerable time, either as farmers or artisans. He thinks that the Galla people originally came from Arabia, and that they once belonged to the Beni-Asd tribe, but it is probable that ethnographers and philologists will hardly agree with him.

Barberton.—Several interesting particulars appear in a recent number of *L'Afrique* regarding this new town, which has sprung up in the Transvaal. A few months ago the centre of the Lydenberg district was inhabited only by lions, zebras, and antelopes, and known only to the Boer hunters; now a town of 6000 or 7000 inhabitants stands there, with numerous shops, two banks, an Exchange, town-hall, several hotels, innumerable public-houses, steam saw-mills, a circus, a post-office, and—crowning mark of civilisation—a newspaper—the *Barberton Herald*. The townspeople flocked together from all parts of South Africa, on the fact becoming known that gold was abundant in the Kaap Valley. They named the settlement after Mr. Barber, one of the first to supply funds for the mineralogical exploration of the region. Barberton is situated on Queen's River, a rapid stream, in a valley 50 kilometres long and 40 wide, 800 mètres above the sea, and surrounded on all sides by hills rising, in some cases, to an altitude of 2300 mètres above sea-level. The valley is watered by several affluents of the Oliphant River. Although the climate is on the whole healthy, fever is not uncommon.

The stir and activity of the new town has had a most beneficial effect upon trade in the Transvaal generally, and upon the Government finances. In one month the taxes levied on imports of food and mining implements amounted to £5000 sterling. An agitation has been set on foot to detach the town from the district of Lydenberg, and furnish it with a special landrost and the right of representation in the Volksraad.

Gold is the one object of thought, talk, and work. Gold fever threatens to become epidemic in South Africa. Naturally, it rages in the town which it has created in the Transvaal, but Cape Colony is also affected, mines having been discovered at Knysna, between Cape Town and Port Elizabeth; and Griqualand East is similarly moved by the opening of gold mines at Kokstad and Natal. The immediate result is a brisk revival of trade; the ultimate influence of the excitement remains for the future to reveal.

AMERICA.

The Eskimo of Stupart Bay.—In the *Proceedings* of the Canadian Institute, Toronto, for November, is given a paper, by Mr. R. F. Stupart, on the Eskimo of Stupart Bay. Mr. Stupart lived for twelve months on the shores of Hudson Strait, took a cruise in the steamship *Neptune*, and made a boat voyage from Prince of Wales Sound to Fort Chimo. Mr. Stupart's work was in conjunction with the Canadian Hudson Bay Expedition of 1884 and 1885, which was to report on the feasibility of establishing a commercial route to Europe from the

Canadian North-West *via* Hudson Strait. Six observing stations were established on the shores of the Strait to watch the tidal currents, and to take meteorological and magnetic observations.

The Hudson Bay Expedition.—The value of the results of the cruise of the *Alert* to explore the region of Hudson Bay, with a view to ascertain whether that sea afforded a practicable route for commerce between Manitoba and England, has been greatly lessened by Lieutenant A. R. Gordon, R.N., withdrawing his report for revision. This, it is said, is due to the arrival of Captain Markham, who was a member of the *Alert* expedition. The two officers evidently differ as to the value of the route for commercial purposes. Lieutenant Gordon's first officially published report stated that freight steamers could not make a passage before July, and that even after that date there would be delays more or less considerable in different years. What will the revised version be?

Preventive Measures against Floods in Montreal.—The Ottawa correspondent of the *Scotsman*, writing on 6th December, states that Colonel Rhodes, the Vice-President of the Quebec Geographical Society, is strongly advocating a scheme for keeping the St. Lawrence River open for navigation during the Winter months, and, as a result, obviating the recurrence every Spring of disastrous floods in Montreal. His plan is to keep the St. Lawrence at Summer level by a central fracture of the ice in Lake St. Peter—a long, wide, and shallow reach of the river some thirty miles below Montreal—by means of a number of boats of sufficient power to cope with the ice pressure. Sealing vessels of the class of the *Alert*, which was used in the Hudson Bay Expedition last Spring, would be well adapted for this purpose. Such vessels would be easily procurable during the Winter, before they start on their sealing expeditions to the Labrador and Newfoundland Coasts. Colonel Rhodes does not go so far as to say that ocean vessels could come up to Montreal in Winter, but local boats between Montreal, Quebec, and the lower provinces, specially constructed for the purpose, he believes could run all the year round—an example of what might be done existing in the Winter ferry-boat service at Quebec, it having been demonstrated by the boats used there that a passage can be kept open.

A Puritan Colony in Maryland, by Daniel Randall, B.A., is the subject of the fourth series of John Hopkins' University Studies in Historical and Political Science. Two columns of English settlers entered the New World in the seventeenth century—the Puritans, who founded, controlled, and moulded the New England States, and the Cavaliers, who took possession of Virginia and other Southern States. The two columns marched for two centuries in almost parallel lines, but at last the principles which each represented culminated in the great fratricidal war which took place between the Northern and Southern United States. Whilst it was mainly the Cavalier stream which flowed south, there mingled with it almost imperceptibly a tiny rill of Puritanism, which has had a great influence on Southern life. The Puritans who settled in Virginia suffered persecution, which, happily, was unknown to the Puritans of New England. So great was this persecution, that it led to an exodus of Virginian Puritans into Maryland, where they founded a colony, and became an important factor in converting what Lord Baltimore had intended should be a feudal State into one governed on thoroughly democratic principles. The struggles and ultimate triumphs of Puritan principles are recorded by Mr. Randall in a thoroughly sympathetic and appreciative spirit. He shows how the old Anglo-Saxon spirit ruled the New World as it did England, and what a congenial soil

the United States proved for the political ideas of Sidney, Milton, and John Locke.

The River Camacuam, South Brazil.—In the number of the *Deutsche Kolonialzeitung*, published on 15th November last, Herr Herman Soyaux describes his voyage in South Brazil, accompanied by Dr. Hermann von Jhering. They sailed up the river Camacuam as far as the town of São José de Patrocinio, and paid particular attention to the navigation and physical features of the river, which winds in a manner peculiar to many rivers. A good sketch-map of the Camacuam district by Dr. H. von Jhering is appended to the paper, from which map-makers will obtain several details that should be introduced into modern maps. The conclusions arrived at by Herr Soyaux regarding the Camacuam are as follows:—1. It is a river with many windings and periodical changes of depth; having a strong current, which sometimes alters its banks; and it contains driftwood, several dangerous sandbanks, and occasional rapids (*cachoeira*). 2. The Camacuam is at present sufficiently navigable to encourage a considerable traffic in wood and charcoal with the town of Rio Grande. 3. The Camacuam is the centre of such a vast territory that, as a waterway, it must always be preferred, for cheapness, to any mode of transport by land. We may add that this river flows into the land-locked sea called the Lagoa dos Patos, and that the most convenient mouth of the Camacuam for vessels to ascend is the one called “Barra das tres bocas.” The river has no fewer than five mouths; but Herr Soyaux specially recommends that above-mentioned. After sailing, as already stated, up the Camacuam to S. José de Patrocinio, a little town of 200 inhabitants, he and his companion struck off northwards on horseback to the colony of São Feliciano, which is situated on the Arroyo Subtil, a tributary of the Camacuam. Nineteen families of colonists, chiefly French and Italians, are settled here, but the colony has not been a success. Herr Soyaux, however, recommends its fertile, well-watered soil to German colonists, provided they are industrious, and accustomed to agricultural labour.

AUSTRALASIA.

Waukaringa Gold-fields, South Australia.—Mr. Clement Wragge, our Corresponding Member, in sending us some published particulars of these recently discovered gold-fields, says:—“If this be a permanent field—together with the finding of water elsewhere in the colony, as already advised—South Australia will rise from commercial depression to find herself a sparkling jewel in the British Crown.” The Waukaringa gold-fields are on Teetulpa run. Waukaringa is 225 miles N.N.E. from Adelaide. The formation is evidently pre-Cambrian (Palæozoic) and is identical with that of the gold-bearing rocks of the Mount Lofty Hills.

The Islands of Torres Straits.—From a Paper by the Hon. John Douglas, Special Commissioner in British New Guinea, we extract the following: A lightship on Proudfoot Shoal, out of sight of land, is the advance-guard of the Australian coast to vessels approaching the Torres Straits from the Arnfura Sea. Sometimes this ship is three months without communication with the shore. About eighteen miles from Proudfoot Shoal is Booby Island, the old post-office of the Straits. Next comes the Prince of Wales group—one of which, Goode Island, with its signal station, commands the channel used by every large vessel passing round the north-eastern extremity of Australia. Bertie Bay, in Goode Island, will some day, according to Sir John Coade, be a great imperial naval

station, but it will be necessary to construct a large breakwater, to break the roll of the waves during the north-west monsoon. Port Kennedy, on Thursday Island, is already one of the finest harbours in Queensland. Prince of Wales Island is quite a considerable little island, about 12 miles square. There is plenty of good water in it ; and though a good deal of it is very rough, stony ground, there is good grass in places—enough for a herd of 1500 or 2000 head of cattle. There is sixty inches of rain per annum, and a fair market for beef at 9d. per pound would be found in Thursday Island. About 100 natives remain out of a former population of 500. Mulgrave and Banks Islands are picturesque, but Captain Douglas had no opportunity of landing on them. He spent two days on Jervis Island, or Manbiaz, as the natives call it. It contains a “shelling” station, and a mission compound, consisting of a church, and schoolhouse, and several houses in which native teachers live. On Sunday there were fully 300 natives at church, all neatly clothed, and most reverent in their behaviour. Mr. Douglas could not fail to appreciate the charm of this gracious influence, which had transformed those savage men and women into civilised human beings. In Sabine Island, close to the coast of New Guinea, the people were on a much lower level, many of them being quite naked. Darnley is the most important island in the Straits—with plenty of good ground, and plenty of water, and inhabited by about 300 persons : fifty being South Sea Islanders, three or four Europeans, and the rest Bingi, i.e. aboriginal Australians. Murray is a beautiful little island, volcanic, and very fertile, but very much among the reefs, and the navigation to and from Murray will always be more or less dangerous, until beacons are set up. At the foot of the hills, along the beach, lie the native village of grass houses. A little above them, at an elevation of probably 100 feet, are the houses of the missionaries. Behind the missionary establishment the hills rise rather abruptly till they culminate in a peak about 800 feet above the level of the sea.

Augusta River, New Guinea.—The New Guinea Company's steamer *Ottilie*, which arrived in Cooktown on 30th August from Finschafen, reports ascending the Augusta River 370 miles, and seeing magnificent country throughout, above the tidal waters. She penetrated to within fifteen miles of the English boundary. The river was very tortuous, and the natives were friendly and numerous. Forests of fine timber alternated with downs and rich scrub land, which was very fertile.

GENERAL.

Telegraphic Enterprise.—The proposed New Zealand cable, says the Ottawa correspondent of the *Scotsman*, has given rise to a contemplated gigantic enterprise, of which Mr. Sandford Fleming, C.E., is the enthusiastic projector, its object being to establish telegraphic communication between Australia, New Zealand, Canada, and Great Britain, by means of a line perfectly independent of existing lines, and freed from foreign influences. This it is proposed to secure by a chain of cables from Brisbane or Sydney to some point in the north of New Zealand, thence *viâ* the Fiji and the Sandwich Islands to Vancouver Island, tapping, on the mainland opposite, the Canadian Pacific Railway. This it would follow eastwards to Gaspé, in the province of Quebec, whence a new cable would be laid through the Straits of Belle Isle to the United Kingdom. The total length of cables contemplated in the Pacific and Atlantic Oceans is 11,135 miles, and the distance across the continent 3450 miles, making in all close on 15,000 miles.

Height and Length of Waves.—During a recent voyage of the U.S.S. *Juniata* to South America, observations, says *Science*, were made as to the height and length of waves, with the following results, as reported by Commander Davis: Height of wave, from hollow to crest, 25 feet; length, from crest to crest, 375 feet; wave-period, 7.5 seconds. The wind-velocity at the time was 10 miles per hour. The height of wave was measured by the elevation at which an observer could see over the crest when the ship was in the hollow. The wave-period was estimated by counting the average number of waves per minute. The wave-length was determined by the time occupied by the crest in passing a measured portion of the vessel's length.

Lake Soundings.—The following soundings are given in *Science* of December in a letter from Mr. John Le Conte:—

Fresh-water Lake.	Height of Surface above sea.		Maximum Depth.		
	Feet.	Mètres.	Feet.	Mètres.	
Temiscouata, . . .	400	121.9	500	152.4	Bailey. Lake Survey.
Superior, . . .	609	185.6	1,010	307.8	
Michigan, . . .	582	177.4	864	263.3	
Huron, . . .	582	177.4	705	214.9	
Eric, . . .	573	174.6	324	98.7	"
Ontario, . . .	247	75.3	738	224.9	
Tahoe, . . .	6,247	1,904.1	1,645	501.4	Le Conte. Dutton. Forel.
Crater, . . .	...	...	1,996	608.4	
Leman, . . .	1,226	373.7	1,017	310.0	
Como, . . .	699	213.0	1,926	587.0	
Maggiore, . . .	686	209.0	2,612	796.0	
Baikal, . . .	1,360	414.5	12,356	3,766.0	

Questions concerning the Condition of Snow in Mountains.—Dr. Friedrich Ratzel, Professor of Geography at the Technische Hochschule, Munich, is at present engaged in the study of the above question, and in the *Jahresbericht der Geographischen Gesellschaft in München für 1885*, he publishes a very interesting paper on the condition and effect of the snow in the Bavarian Alps. As appendix to this paper, he gives a list of questions, which he requests all friends of geography to answer. We reproduce them here, as we think that some of our readers will be interested in them, and may probably be able to provide the Professor with some information. He says, "important results for geography, geology, and meteorology may be obtained from an examination of the depth, the extent, and the duration of the snow in mountains." The questions are as follows:—

1. When does the first snow fall upon the mountains in your district? How high are these mountains? If drawings can be obtained of them, please say where.
2. From what date does a complete or partial covering of snow lie on the mountains?
3. When does the snow generally lie around your place of residence? What is the height of the same above the sea-level?
4. Are the mountains in your neighbourhood ever completely free from snow during the winter? At what height, and upon which side, does this take place earliest?
5. At what date does the greatest part of the winter snow-fall melt?

6. How long do the last remains of the snow lie?
7. How far down the mountains does the remaining snow extend?
8. In which part of your district is the snow generally deepest? How deep is it?
9. In which part of your district are the greatest snow-drifts? How do the mountain spurs stand in relation to the drifts?
10. What influence does the formation of the land have upon the continuance of the snow-fields? (Particular attention is to be paid to the steepness of the cliffs, the peaks, the ravines, the origin of valleys, and the cavities.)
11. What influence has the nature of the surface upon the length of time the snow lies, according to whether it is rock, rubble-stones, sand, or earth?
12. What influence does the vegetation, especially forest, exert on the length of time the snow lies?
13. What influence is exerted by the neighbourhood of water on the time the snow lies? Marshes and moors are also to be taken into consideration.
14. What influence does the greater or less porosity of the soil exert upon the lying of the snow?
15. After what time does the snow become granular? Under what conditions does it change into ice? Granular, vesicular, and clear ice are to be differentiated.
16. Are fissures and crevices noticed in the snow-fields?
17. Are movements observed in the snow-fields? Or, are traces found in your neighbourhood which point to movements taking place?
18. Do avalanches occur in your district? Can their cause be found out? What can be said of their influence upon the land and vegetation (forests)?
19. Are any remarkable forms observed on the upper surface of the snow in consequence of the action of wind melting, or of other circumstances?
20. Are definite strata visible in the snow?
21. How great is the influence of the melting of the snow (even in winter) upon the height of the water in the rivers or lakes of your district? How soon after the commencement of the melting of the snow is this noticed?
22. In which watercourses is the influence of the melting of the snow first noticed? Is there any difference noticed in this respect between the various mountain spurs?

MISCELLANEOUS.

The railway between **Algiers** and **Constantine** is now open for traffic.

The maritime frontier between **Tunis** and **Tripoli** has been fixed at **Ras-Tadjir**, about 12 miles from **Biban**, in the neighbourhood of the **Zuara** oasis.

The Budget Committee of the German Reichstag has voted 150,000 marks, to be used for assisting scientific enterprise in **Opening up Central Africa** to civilisation.

A movement has been initiated at **Caracas**, and is now engrossing public attention in **Venezuela**, for uniting the three Republics of **Venezuela**, **Colombia**, and **Ecuador** into a great State, to be styled "**La Gran Colombia**."

Emin Bey has been promoted to the rank of **Pasha** by the Egyptian Government, who, besides recognising his position as their representative, have voted a sum of money towards the expenses of an expedition for his relief.

Dr. Junker telegraphs from Zanzibar : " Explored **Makua**, which is generally navigable, but has some rapids." He has traced it to 22° E. long.—two degrees east of Grenfell's farthest, where it was still navigable at low water.

A Canadian treaty with the **Sandwich Islands** is being arranged for, which, from the completion of the Pacific Railway, and the establishment of a Pacific steamship line, will probably create a large trade between the two countries.

Colonel Gilder and his assistant, Mr. Griffith, who started on their Polar expedition some months ago, have been heard from at Oxford House, a Hudson Bay port. Colonel Gilder and his assistant were reported as well, and full of enthusiasm over their North Pole expedition.

M. Maigrot, the Italian Consul-General in **Madagascar**, has obtained the concession for a railway on the eastern coast of Madagascar, to connect Fenoarivo, in the north, with Matitana, in the south. The construction and exploitation of the line will, it is stated by *L'Afrique*, be conducted by a French company.

Professor Forel de Morges, says the *Club Alpin Français*, has discovered, under the long terminus of the **Arolla Glacier**, a natural gallery traversing the whole length of the glacier. The height of this gallery is from 2 to 3 mètres, its length is 250 (?) mètres, and the space between the two sides varies from 6 to 25 mètres.

The *Deutsches Tagblatt* states that the Sultan of **Zanzibar** has addressed to Prince Bismarck a letter, in which his Highness informs him that the Treaty of Commerce recently concluded between him and the German Government has resulted in a sensible diminution of his State revenue, and, in order to adjust this deficit, he proposes to partly modify the stipulations in the treaty.

Mr. R. E. Peary, according to information received in Copenhagen, with two companions, has effected his trip into the **Interior of Greenland**. Mr. Peary went 130 miles into the interior, not meeting with protruding mountain peaks or anything remarkable ; all was one pretty even surface of ice. The journey was made for the most part in sledges, and the return voyage was made with extraordinary speed before a south-east gale. The party were about three weeks on the ice, and were warmly welcomed back by the Greenlanders, who had feared they were lost. Mr. Peary proposes to undertake a similar excursion next summer.

To the meeting of the Edinburgh Botanical Society, held on the 11th November, the Rev. D. Landsborough, Kilmarnock, forwarded a contribution on Australian and New Zealand plants growing in **Arran**. Arran, he said, was the most northern locality where Australian plants had been successfully cultivated. Nine species of gums were growing in Arran. These included the most interesting species. They did not, in general, grow with the wonderful rapidity of gums in Australia, though the blue gum added 4 feet yearly to its height, and the white gum 2½ inches to its girth. In consequence of the moist, mild, and comparatively uniform temperature of the island, and also the influence which sea air was known to exert in adding to substance and size in foliage, it was believed that they were as luxuriant as those of Australia.

Another railway scheme, says the Ottawa correspondent of the *Scotsman*, is now on foot in Manitoba—the proposed line to be styled the **Winnipeg and North Pacific Railway**. The district through which it is to pass is possessed of a highly fertile soil, and traces of mineral wealth have been found in its vicinity. Starting

from Winnipeg, it traverses in a north-westerly direction, bending to the west, and strikes the Pacific Ocean at Port Simpson. It will open up the northern habitable section of the Territories in the same way as the Canadian-Pacific has opened the southern. An Act of Incorporation was passed during the last session of Parliament. As a route for trans-continental trade it has several advantages, Port Simpson being four hundred miles nearer Yokohama than Port Moody, the terminus of the Canadian-Pacific, and six hundred miles nearer than San Francisco. This saving of distance will tell materially in its favour.

NEW BOOKS.

Geography of the British Isles, from Ten Different Standpoints, with 21 Maps. By T. M. DAVIDSON, M.A. London: Thomas Laurie. Price 2s. 6d.

The aim of Mr. Davidson's book seems to be the simplification of geographical teaching by means of a systematic division of his subject, according to the different standpoints from which it may be viewed. The author, with some originality, divides the geography of each country into ten separate sections, each illustrated by a special map; the text is so written that the book is rather a series of lessons on a set of maps than a Geography illustrated with maps. The pupil's mind is concentrated on one subject at a time, treated in its progressive order so clearly and briefly that it cannot fail to be readily understood. Altogether, the book will greatly facilitate the teaching of elementary Geography and ought to become popular as a class-book.

James Hannington, D.D., F.L.S., F.R.G.S., First Bishop of Eastern Equatorial Africa. A History of his Life and Work, 1847-1885. By E. C. DAWSON, M.A. Oxon., Incumbent of St. Thomas's Church, Edinburgh. London: Seeley and Co., Essex Street, Strand. 1887. Pp. 451.

The name of Bishop Hannington requires no introduction to the readers of the *Scottish Geographical Magazine*. In the volume before us, one of his closest personal friends has told the story of his life—the pleasant waywardness of his youth, the heroic devotion of his manhood, and the pathos of his last days of lingering martyrdom—with no small share of literary skill, and with a good deal of that infectious admiration which, when it is not too aggressive, forms the most fitting atmosphere for the biography of a good man.

James Hannington was born at Hurstpierpoint—"Hurst, as the inhabitants call it for brevity's sake—a pretty little village in the south of Sussex, about eight miles from Brighton." The first thirteen years of his life were spent at home, and in travelling and yachting with his elder brother or parents. Much of the experience of that time must have "come in handy" to the explorer-bishop. After his school-days were over, the lad went into his brothers' business—not, however, to remain long. The erratic nature which his education had rather developed than repressed, and still more the religious instincts and convictions which had been taking hold of him, ultimately prevailed; and from Oxford, where he took his M.A. degree in 1875, he passed into the service of the Church of England. Mr. Dawson gives a very interesting account of the work at Hurst of the young cleric, who was as energetic, unconventional, and enthusiastic as one could wish, placing himself in direct contact with his people, and sacrificing himself to their interests. At length, in 1882, he was called to labour in a very different field. The Church Missionary Society

intrusted him with the leadership of an expedition intended to reinforce their mission in Central Africa, where Mr. A. M. Mackay and the Rev. P. O'Flaherty were established at Rubaga. Landing at Zanzibar on June 19th, the company of seven Europeans proceeded to the interior by way of Mpwapwa (August 2d) Uyui (September 4th). At Uyui, Hannington was seized with dysentery, and before the next ten days was brought to the very door of death; the other members of the mission determined to leave him "in the brotherly hands of Mr. Copplestone, and under the special charge of his nephew, Cyril Gordon." The caravan, now led by Mr. Stokes, had not advanced far on the old road to the Lake Victoria Nyanza when an attempt of the natives to extract an extortionate hongo by force of arms obliged it to return, to complain to Mirambo. This return enabled Hannington again to join his party, though he was so weak he had at first to be carried in a hammock. By the 6th of November he was so much better that he attempted the ascent of a mountain. Two days later they were at Kwa Sonda, and soon after reached the lake at a point to the west of Kagei and Jordan's Nullah. Mr. Stokes now returned to the coast, and as two other missionaries had been left at Uyui to take the place of Mr. Copplestone, Hannington and Mr. Gordon alone were left to proceed to Uganda. Supplies had run short; the horrors of the rainy season were upon them. The entry in Hannington's diary for *Christmas Day* 1881 runs as follows:—"Gordon very ill in bed. Ashe and Wise tottering out of fever beds; I myself just about to totter in again. In spite of our poor condition, we determined to have our Christmas cheer. . . . I killed a kid, and Ashe undertook the pudding." . . . A move was made in the direction of Romwa, the King of U-zinza's camp, on 30th of December. Owing to the roguery of Rashid, the Arab employed to bring up the boat, the party was now almost without cloth—that is, penniless. At Kagei, Hannington and Gordon were received with great kindness by Sayel bin Saif, the white man's friend, and by the French Jesuit missionaries, whose timely succour probably saved their lives. On January 30th, he took leave of the brotherly priests, but the very day after he was again very ill with dysentery and violent internal pain, and was compelled to return instead of pushing on to Uganda. How bitterly he felt the disappointment is shown by such letters as:—"I am not dull at my broken health and the constant pain I suffer. I am not dull at the very slight prospect that I shall ever reach home. I am dull because I think that a very few pounds extra in outfit would have made an immense difference to me. If I live a little longer I will write out a list of things I have personally suffered much from not having. Ten pounds will, I think, cover them all. I blame no one. It was simply a matter of want of experience. But alas! it cost both myself and the Society much, for I am a practical failure, and I have suffered terribly." By the 12th of May he was in the steamer at Zanzibar homeward bound. "Already the project was forming in his heart to revisit the dark land from which he had been compelled to flee." On June 24th, 1884, he was consecrated as Bishop of Eastern Equatorial Africa, and on Saturday, January 24th, 1885, he landed at Mombasa to settle at Frere Town, the central station of the Church Missionary Society. "Here," in the words of his biographer, "he roused up everybody by his own indefatigable energy. None could settle with any comfort upon their lees while the bishop stirred about so briskly and displayed such boundless powers of locomotion. To-day in Mombasa, to-morrow at Zanzibar, a few days later at Taita, again prospecting round Kilima-njaro, and suddenly, while all thought him far away in the interior, reappearing in the streets of Frere Town." The account of the bishop's visit to Taita and Kilima-njaro is one of the most interesting in Mr. Dawson's book: he

was greatly charmed with some of the highland scenery, and writes of Chagga (which is now occupied as a station by the Church Missionary Society), "May God give Chagga to His Son! It is a lovely spot. I often exclaimed, 'Here is England: England, yes, and that part of England which I love best—dear Devonshire.'" In April 1885 the bishop once more stood "sunburnt and shaggy, but glowing with health, on the threshold of his own house at Frere Town."

"He was overjoyed to think that upon this new route westward there were no difficulties which might not be overcome by courage, prudence, and experience. No ghastly malarial fevers; no cruel dysenteric attacks, such as on the lower road reduced the strength of the strongest man, and neutralised his bravest efforts. When he compared his experiences upon this journey with those of his terrible march of death from Zanzibar to the Lake in the previous year, he was filled with a kind of triumph. What if it were possible to push straight through, as Thomson had done, to the north end of the Nyanza! Might not many lives be saved, and incalculable suffering averted? Already the idea began to form itself definitely in his mind. The idea, once started, formulated itself rapidly. The more he thought about it, the more feasible did the new route appear. The way was shorter by a very considerable distance; it was incontestably healthier; it lay through a country which, in many places, possessed an English climate, and was thoroughly suitable for European residence: there was at that time no reason to suppose that the Ba-ganda would offer any opposition to an approach from the north-east. The only serious difficulty appeared to be the lawless and irrepressible Masai. Well, Mr. Thomson had proved that it was quite possible to pass through the country of these truculent warriors without danger much greater than was incidental to all African travelling through unexplored regions. Jumba Kimameta and other traders were in the habit of taking caravans regularly backwards and forwards through the heart of the Masai country; and, in fine, Hannington did not believe that there were any insurmountable obstacles to the establishment of a chain of Mission Stations which should extend from Mombasa, through Taita or Chagga by Lakes Naivasha and Baringo, to U-Ganda. But the weightiest chain of thought is, like other chains, no stronger than its weakest link; and ignorance of a single detail may upset the conclusions of the most cogent reasoning; and the bishop and his friends were unfortunately ignorant of one fact of which we, who are wise after the event, are now aware. I mean the suspicion and fear with which all visitors from the north-east are regarded by the people of U-Ganda."

On the 10th of October 1884, about a month before the bishop sailed from England, an event occurred which most seriously affected all Church work in Central Africa. Mtesa, King of Uganda, died, and was succeeded by his son, Mwanga. The new king's suspicions and fears against the progress of Christianity were aroused by the conservative chiefs. Persecutions of the most terrific kind were set on foot; and though the lives of the European missionaries were spared, it was evident that at any moment they too might be attacked. Hannington had reached the north end of the Lake when he was stopped by one of Mwanga's chiefs; and on October 29th, 1885, he was murdered by the authority of the very chief to whom he had most trusted for the success of his mission.

Mr. Dawson has done his task well; he has presented a short and attractive picture of a fine and manly—though, it may be, eccentric and somewhat unpractical—nature; and there is hardly a sentence we would wish to blot.

History of the Land Question in the United States. By THOSUKE SATO, Ph. D., Japanese Commissioner. Published by the Johns Hopkins University, Baltimore, 1886. Pp. 181. Price \$1.

"This work," says Dr. Sato, "was undertaken in pursuance of special

instructions from the Japanese Government to investigate certain questions of agrarian and economic interest in the United States." British reformers are busy with the Land question, as affecting the Irish peasantry and the Scottish crofters, but in the United States also it is a "burning question." It has, Dr. Sato continues, "steadily advanced to a foremost place among the reform measures of the national administration," and the recent demands of the "Knights of Labour," at their convention at Cleveland, Ohio, have brought the agitation to a crisis. Their chief demands are that public lands be reserved for actual settlers only, and that after 1886 aliens be prohibited from obtaining titles to land in the United States.

Dr. Sato treats fully of the Land question in the United States, from the days when English colonists occupied North America, down to the present time. The final passage of the Homestead Act in 1862, under President Lincoln, affirmed the principle of a free homestead being granted to *bona fide* settlers. "The homestead law, as it now stands, grants to every applicant who is the head of a family, or above the age of twenty-one, 160 acres of public land, or a less quantity in legal subdivisions, free of charge, except certain fees to the register, on the condition of actual settlement and cultivation. The title passes to the homesteader after five years' residence upon the holding. But if he desires to secure the title earlier, he can do so by paying the Government the full minimum price of the land." At the same time, by availing himself of the "Pre-emption law," as well as the "Homestead Law," a settler may increase his holding to 320 acres. "The most beneficial provision of the Homestead Act is the exemption of the homestead from the obligation of debt contracted prior to the issue of the patent."

The available public lands of various descriptions in the United States, exclusive of Alaska, which still remain unsold, amount to more than 640 million acres. Dr. Sato, however, thinks that the wise, economic, and judicious administration of these still unsold lands will be impossible "without first reforming the existing land laws, which are much abused by unscrupulous land-grabbers." From 1850 to 1872 no fewer than 155 million acres were granted to railway corporations. "Of these," says Dr. Sato, "more than one-third had already been patented, but the rest ought to be recovered by the Government on account of non-fulfilment of various conditions stipulated in the grants, as well as for the interest of honest settlers." His last words are significant. They are directed against "land-grabbers and cattle kings," and indicate his view of what should be the future policy of the public land administration. "These words are Reform and Recovery—reform of legal abuses, and recovery of the public lands from railroad corporations."

In the New Hebrides: Reminiscences of Missionary Life and Work, from 1850 till 1877. By Rev. JOHN INGLIS, D.D. Edinburgh: T. Nelson and Sons, 1887.

The learned and accomplished author of *A Grammar and Dictionary of the Aneityumese Language* has, in this volume, produced a work not only of popular and missionary interest, but of much scientific value. Marked by literary grace, and most readable, it presents, in almost all other respects, a contrast to the *Cannibals and Convicts* of Mr. Julian Thomas, noticed in our last issue. Dr. Inglis has evidently all the modesty of true knowledge and self-sacrificing worth. We have nowhere such accurate and experienced accounts of the geography, meteorology, and ethnology of the New Hebrides group, as in the first four chapters, illustrated by a map which shows also the Loyalty

Islands and New Caledonia with its fine harbours. How, along with the Canadian founder of the mission, Dr. Geddie, the author, encouraged by Sir George Grey and Bishop Selwyn, civilised the three thousand five hundred cannibals of Aneityum, and that in the higher and most permanent sense, may be seen from the fact that the former found them all heathen, and the latter left them all Christian. The population have this month sent 4090 lbs. of the finest arrowroot for sale in Scotland, as their contribution—worth £200 net—to the Church which has sent out their missionary, now Mr. Lawrie. The chapters on the language, and the translation of the Bible, on eclipses, earthquakes, and the tidal wave, on the labour traffic, and the French pretensions and evil doings, are of equal interest. We trust Dr. Inglis will publish the rest of his rich ethnographical materials in another volume.

New South Wales and Victoria in 1885. By DOUGLAS M. GANE.

London : Sampson Low and Co.

If we are not familiar with our Australian Colonies, and the route thither, it is certainly not for want of books. Mr. Douglas Gane gives a pleasing account of his observations during a voyage to Australia, and a tour through Victoria and New South Wales. The book is one which may appeal to those contemplating a health tour to Australia. A special chapter contains information on the climate, as affecting consumptive invalids, and gives particulars that ought to be useful to an intending tourist.

NEW MAPS.

(*Edited by Professor James Geikie, LL.D., F.R.S.*)

AFRICA.

KONGO, Die Nebenflüsse des mittleren—Lulongo, Tschuapa, Mobangi, u.a. Nach den Aufnahmen von Premier-Lieutenant Curt. von François, und Reverend George Grenfell, 1884-1885. Massstab, 1 : 2,000,000.

Petermann's Mitteilungen, Jahrgang 1886, Tafel 16. Gotha : Justus Perthes.

This is a map of the Congo from Kwa Mouth to Stanley Falls, and is by far the clearest and most detailed survey of the river and its tributaries that we have yet seen.

ÆQUATORIAL OST-AFRIKA, Vorläufige Skizze von Dr. G. A. Fischer's 3ter Reise, 3 August 1885 bis 14 Juni 1886. Massstab, 1 : 4,000,000.

Petermann's Mitteilungen, Jahrgang 1886, Tafel 19. Gotha : Justus Perthes.

Dr. Fischer's route is here shown on a cutting from Justus Perthes' large map of Africa. The only important alterations that appear to have been made on it deal with the hydrography of the country immediately south of the Victoria Nyanza.

OST-AFRIKA, Originalkarte von Joachim Graf Pfeil's Reisen in —. Oct. 1885 bis Feb. 1886. Massstab, 1 : 1,750,000.

Petermann's Mitteilungen, Jahrgang 1886, Tafel 18. Gotha : Justus Perthes.

This map includes the countries recently annexed by Germany occupying the basins of the Rufiji and Wami rivers, lying inland from Zanzibar.

SAHARA, Carte géologique du—, du Maroc à la Tripolitaine et de l'Atlas au Ahaggar. Echelle, 1 : 5,000,000. Par M. G. ROLLAND.

Bulletin de la Société de Géographie de Paris, 2^e Trimestre, 1886.

OCEANIA.

TARAWERA DISTRICT, NEW ZEALAND, Plan of the Volcanic Eruption 10th June 1886, with resulting changes in the topography.

Proceedings of the Royal Geographical Society, December 1886.

GENERAL.

BERGHAUS' PHYSIKALISCHER ATLAS. Siebente Lieferung. Inhalt : Nr. 31, Isothermen von Nord-Amerika (Dr. J. HANN) ; Nr. 48, Florenkarte von Asien (Dr. O. DRUDE) ; Nr. 56, Verbreitung der Reptilien (Dr. W. MARSHALL).

Gotha: Justus Perthes, 1886. Price, M. 3.

THE QUEEN'S JUBILEE ATLAS OF THE BRITISH EMPIRE, with Descriptive and Historical Notes, and Statistical Tables. By J. FRANCON WILLIAMS, F.R.G.S.

London and Liverpool: George Philip & Son, Price 1s.

The Queen's Jubilee Atlas is one of those patched-up publications coming under the class of cheap reprints, and contains no feature worthy of special commendation except its cheapness. We should thus have passed it over without further notice had we not observed on its title-page a name which is indeed new to cartographers—"J. Francon Williams." Now, had not all the maps in this atlas been already familiar to us, as selections from Messrs. Philip's various atlases, and as the work of the late Professor Hughes and Mr. Bartholomew, we should naturally have inferred that they were the work of Mr. Williams.

That the public will be misled in this manner there can be little doubt, so we feel it necessary to bring a case of such a nature before their notice. It is a great injustice to the real authors of the maps, and very prejudicial to the interests of cartography, that any man should be allowed to gain a reputation by merely prefacing his name to other people's work.

THE "WORLD" SERIES of Class Lesson Maps and Diagrams.

London and Edinburgh: Ruddiman Johnston & Co. Price, each Map, 1s., or on cloth, with rollers and varnish, 2s.

The publication of the "World Series" of school maps is a decided advance in the direction of supplying really satisfactory apparatus for the teaching of Geography. The series at present consists of about ninety maps, and has several new features worthy of notice. It is based on the plan of illustrating each division of the geography of a country by a separate map, and these maps are so prepared that they fully and clearly represent only the special subjects to which they are devoted. Thus, in this manner, we require some six or seven maps for the geography of each country, commencing with a delineation of the elementary physical features, such as coast-line, rivers, mountains, etc., and gradually progressing towards the illustration of temperature, rainfall, political divisions, manufactures, etc., all of which subjects have special maps. By this system the pupil is advanced in geography step by step, on the wholesome principle of thoroughly mastering one subject at a time. The whole series is produced in bright colour-printing, in very good style, the only objection being that, for large classes, they are too small and minute.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ON THE TOTAL ANNUAL RAINFALL ON THE LAND OF
THE GLOBE, AND THE RELATION OF RAINFALL TO
THE ANNUAL DISCHARGE OF RIVERS.

BY JOHN MURRAY.

(Abstract of Paper read before the Royal Society of Edinburgh, 17th January 1887.)

It is well known that the earth is surrounded by three atmospheres, one of oxygen, one of nitrogen, and one of water vapour. In the case of the oxygen and nitrogen, a complete mixture takes place throughout the whole atmospheric envelope according to the known laws of gaseous diffusion. A similar complete mixture is never attained in the case of aqueous vapour; this arises from the fact that the equilibrium of the water-vapour atmosphere is continually being disturbed by the ceaseless processes of condensation and evaporation, the amount of which varies with every change of temperature and pressure. Vapour is ever passing into the air at all temperatures and pressures from the surface of the sea and land, and is as continuously being withdrawn again from the air in the form of rain, snow, hail, and dew-drops. There is, in reality, a continuous aqueous aerial circulation, constant currents of water passing, as it were, from ocean to continent, and from one portion of the surface of the land and sea to another.

This circulation plays such an important part in many terrestrial and oceanic phenomena that it is evidently a matter of considerable importance to be able to estimate, even approximately, its absolute amount as a whole, and its relative amount on different regions of the earth's surface, as well as to estimate what portion of the rain that falls on the land finds its way back again to the ocean by means of rivers. It is admitted that our knowledge of the rainfall on the surface of the land is very incom-

plete, and our knowledge of the amount of water discharged by the principal rivers of the globe cannot be said to be in a more satisfactory state than our knowledge of the rainfall. Still, with the data at present available, the estimates above referred to have been made, and the results are presented in this communication, so far as the investigation has up to this time proceeded.

Professor Loomis of Yale College has for many years collected data concerning the annual rainfall in the different regions of the world, and has portrayed these on a map of the world by means of lines passing through places of equal rainfall. Taking the data furnished by Professor Loomis' map as a foundation, I have transferred these to maps of the world on an equal surface projection.¹ The maps which accompany this paper are reduced by Mr. Bartholomew from those used in the investigation. The maps were revised for me by Mr. Alexander Buchan, who has added the most recent information available, and has advised me as to the mean annual rainfall which should be adopted in estimating the rainfall in each area.

The planimeter was used in defining the extent of the areas where the rainfall was under 10, between 10 and 25, 25 and 50, 50 and 75, and over 75 inches annually, and from these data the total annual rainfall on the land has been calculated.

In like manner there has been estimated the total amount of rain falling on each of the continents and principal islands, on each ten degrees of latitude north and south, on each of the drainage areas of the oceans and inland drainage areas, and on the catchment basins of many of the principal rivers. The results are set forth in the accompanying tables.

From an inspection of these tables it will be seen that the total annual rainfall of the globe is estimated at 29,350 cubic miles, which is the mean of several measurements. Of this amount 2,243 cubic miles of rain fall on the inland drainage areas of the globe, such as the Caspian, Sahara, and similar areas in all the continents. These inland drainage areas occupy 11,486,350 square miles, and as no water is discharged from them into the ocean it follows that all the water which falls as rain must be again returned to the atmosphere by evaporation. Should the water accumulate in these areas into lakes, and these lakes show a slight annual increase in size, then the rainfall must be regarded as greater than the evaporation; but when, as in the case of the Great Salt Lake of North America, the size of the lake slowly diminishes, then the evaporation over the basin must be greater than the rainfall.

The rainless regions of the earth correspond in locality very closely with these inland drainage areas, the rainless regions being defined as those in which the annual rainfall is less than 10 inches. The area of such regions is 12,200,000 square miles. Again, the inland drainage areas, the rainless regions, and the great desert regions, largely coincide,

¹ See *Scottish Geographical Magazine* for September 1886, p. 549.

or overlap each other, and are situated in two belts around the world, one in the northern hemisphere, approximately between the latitudes of 30° and 40°, and one in the southern hemisphere, approximately between the latitudes of 20° and 30°, the configuration of the land determining to a large extent their position. In the northern belt there are the Desert of Gobi, the Aral and Caspian basins, the Dead Sea area, the deserts of Arabia, the Sahara in North Africa, and the Great Salt Lake and Alkali deserts of the Rocky Mountains. In the southern belt there are the arid region of the interior of Australia, the Kalahari desert of Africa, and the Atacama desert of South America.

The area of the inland drainage areas is a little over one-fifth of the total land of the globe. Were evaporation to take place over the whole land at the same rate as from these inland areas, it would be equal to about one-third of the total rainfall; but it is evident that the evaporation from inland areas is much less than it would be were more water present in them. The Mediterranean and Red Sea, for instance, are situated in one of the driest of these regions, and the evaporation from their surface must be enormous. The discharge of rivers into the Mediterranean and Black Seas is estimated at 226 cubic miles, and the area of their combined surfaces at 1,053,000 square miles. Not only is all the 226 cubic miles of water evaporated from the surface of these seas, but a very large quantity in addition, for, as is well known, the water of the Mediterranean is saltier than that of the Atlantic with which it communicates. Fresher Atlantic water continually flows in through the Straits of Gibraltar, while saltier dense water flows out as an under-current from the Mediterranean to the Atlantic. Saltier water also flows as an under-current into the Black Sea, while fresher water flows from the Black Sea into the Mediterranean at the surface.

The primary cause of the rainless, desert, and inland drainage areas is to be traced to the fact that they are situated in those regions of the earth's surface where the winds blow from colder to warmer latitudes, and from off land and not from off the ocean. An examination of the accompanying maps in connection with one showing prevailing winds will make this at once apparent.

As none of the rain falling on inland drainage areas ever reaches the sea by means of rivers, these areas may be deducted from the total land of the globe, which leaves 44,211,050 square miles of land which drain into the ocean. Of this 44,211,050 square miles, 26,400,000, or considerably over one-half of it, drain into the Atlantic Ocean and the basins which open into it, as the Mediterranean, Baltic, and Arctic Ocean; and of the 27,110 cubic miles of rain which fall on the land draining into the oceans, 15,788 cubic miles, or more than one-half of the total rainfall of the globe, falls on the Atlantic drainage area. The amount of rain falling annually on the Pacific and Indian Ocean drainage areas is respectively 5,007 cubic miles, and 4,379 cubic miles, or in each case less than one-third of the rain falling on the Atlantic Ocean drainage area.

The rain or snow falling on the Antarctic continent is estimated at 1,688 cubic miles. It will thus be seen that the Atlantic is as remarkable for the amount of rain falling on the land draining into it, as for the extent of that land itself, when compared with the land draining into the other oceans. This fact, as will be pointed out in another paper, has a very important influence on the nature of the deposits now forming in the Atlantic, as compared with those of the Pacific.

In the table showing the rainfall according to latitude, it will be noticed that the greatest amount of rain falls on the land within the tropical regions, and that the amount per square mile diminishes on the whole, but somewhat irregularly, towards the poles. It will be noted that there is a slight diminution between 20° and 30° South, and 30° and 40° North, which is evidently due to the great extent of the rainless regions in those latitudes. South of these latitudes in the southern hemisphere, there is a very considerable increase of the amount of rain per square mile, which is to be accounted for by the relatively small proportion of land to sea as compared with the northern hemisphere, where there is a decrease per square mile as the North Pole is approached. The total amount of rain falling on the land also diminishes towards the poles, with the exception of that falling on the Antarctic continent. The rainfall on the land surrounding the South Pole has been estimated as being on the average 30 inches per annum. It is unlikely that this is too high, when we remember that the winds blow into it cyclonically from the surrounding Southern Ocean, carrying with them the moisture evaporated from lower latitudes, and that on the borders of this land there is at some seasons almost constant precipitation.

The area of the land between 30° North and 30° South is 25,628,550 square miles, and the rain falling on this land is estimated at 18,891 cubic miles, or nearly two-thirds of the total rainfall on the land of the globe. The land between 30° North and the North Pole is estimated at 24,114,800 square miles, and the rainfall on it at 7,580 cubic miles. The land between 30° South and the South Pole is estimated at 5,521,300 square miles, and the rainfall on it at 2,639. It will thus be noticed that of the rain which falls outside of the 30° North and South, a larger quantity falls in the southern in proportion to the quantity of land than in the northern hemisphere, which was to have been expected from the greater extent of water surfaces in this part of the globe.

A study and comparison of the appended tables reveal many other interesting facts of a similar kind, and many relations might be pointed out between the nature of the regions, their animal and vegetable productions and populations, in which there is a small or a large annual rainfall, did such considerations come within the scope of the present paper.

Turning now to the consideration of what becomes of the water which falls upon the land in the form of rain, snow, hail, and dew, it is at once evident that by far the larger portion of it, after remaining for a

longer or shorter period on the land, is evaporated and carried away again by the atmosphere. That portion of the rainfall which is used up by plants and animals may be regarded as a constant quantity, for the amount locked up in the bodies of one set of organisms in the course of a year may be regarded as equivalent to what is returned by the death and decay of another set during the same period. A very large quantity of water has doubtless been stored up in the deeper parts of the earth's crust, and much of it permanently fixed through the hydration of minerals; although the total amount of rainfall which has disappeared in this way must be very large, and be constantly increasing, still its annual amount must be relatively very small, and may be neglected in the present discussion. The water which finds its way to the ocean by underground channels is also probably small in annual amount, and for our present purposes may be left out of account.

The difference between the total rainfall on the land and the total amount of water discharged by rivers into the ocean may then be regarded as that portion of the rainfall which is evaporated from the land in the course of the year; and the total amount of water discharged by rivers annually is a measure of the excess of evaporation over precipitation on the oceans and seas, as well as a measure of the excess of precipitation over evaporation from land surfaces.

In only a relatively few cases have the discharges of rivers been estimated with great care: in the majority of cases there is considerable divergence in the statements by different authorities as to the annual discharge of the same rivers. In the accompanying table (VI.) there are given the areas of the catchment basins, a mean of the annual discharges, and the mean ratio of the discharges to the annual rainfall on the basins of thirty-three rivers, concerning which we appear to have the most trustworthy information.

The proportion of the rainfall on the catchment basin of a river to the amount of water discharged at its mouth varies according to the geographical position of the river. In the case of European rivers, between one-third and one-fourth of the rainfall reaches the sea. One-third of the rain which falls on the British Isles is believed to reach the sea by rivers. The Mississippi has been estimated with great care, and it is found that one-fourth of the rainfall is discharged into the Caribbean Sea. The St. Francis and Yazoo, tributaries of the Mississippi, which flow through a wooded country, deliver nearly all the rainfall at their mouths. It would appear that fully one-half of the rain which falls on the basin of the Yukon in Alaska finds its way to the sea. Within the tropics a very much larger proportion of the rainfall would appear to be evaporated. The Nile, the lower part of which flows through an exceptionally dry and sandy region, delivers only about $\frac{1}{3}$ of the rainfall on its catchment basin into the Mediterranean; but the usual discharge of tropical or sub-tropical rivers appears on an average to be about one-fifth of the rainfall on the river's basin.

The thirty-three rivers given in Table VI. drain 13,272,000 square miles of land, and discharge into the ocean 2,182 cubic miles of water. If water were discharged from the whole land of the globe at the same rate, the amount per annum would be 9,159 cubic miles. This is, however, much too high a number for the total discharge; to make a fair comparison it is necessary to deduct from the land of the globe all the inland drainage areas, for we have seen that no water drains from them into the sea. When the inland drainage areas (11,486,350 square miles) are deducted from the total land of the globe (55,697,400 square miles) there remain, as we have seen, 44,211,050 square miles. If the discharge of water from this land were at the same rate as from that drained by the thirty-three rivers, the total discharge into the ocean would be 7,270 cubic miles per annum. Even this number is too high, for the thirty-three rivers represent chiefly regions where the rainfall is very considerable, and poorly represent regions of the earth's surface (outside the inland drainage areas) where the rainfall is under 10 inches annually, nearly all of which may be regarded as evaporated. Making deductions suggested by these considerations, there remain 39,697,400 square miles as the area of the earth's surface from which water drains into the sea; and the total discharge from this land is calculated, in the same way as above, to be 6,528 cubic miles annually, or to the total rainfall on the land of the globe as 1 to 4.496.

There is, however, an advantage in considering the rainfall in connection with the discharge in different regions. With this view if we take the discharge of fourteen¹ rivers (in Table VI.) whose basins are for the most part situated between the latitudes of 30° N. and 30° S., we find that they drain 9,117,000 square miles, and discharge into the ocean 1,694 cubic miles. At this rate the whole of the land between 30° N. and 30° S. (25,628,550 square miles) would discharge 4,763 cubic miles, but deducting the inland drainage areas situated in these regions the total discharge into the sea would be 3,740 cubic miles, which is to the rainfall between 30° N. and 30° S. (18,891 cubic miles) as 1 to 5.051.

If now we take the nineteen rivers (in Table VI.) whose basins lie mostly or wholly outside of 30° N. and 30° S., we find that they drain 4,155,000 square miles, and discharge into the sea 488 cubic miles. At the same rate all the land north and south of the 30th parallels (29,643,100 square miles) would give 3,197 cubic miles. Deducting the inland drainage areas in these regions, the discharge would then be 2,779 cubic miles, or to the rainfall in the same regions (10,219) as 1 to 3.677. The total discharge is by this calculation 6,520 cubic miles; by the previous calculation it was 6,528. The mean of these two numbers, or 6,524 cubic miles, may be taken as approximately the amount of water which is discharged from the land by rivers in the course of a year.

¹ Congo, Nile, Orange, Yang-tse-kiang, Irawadi, Ganges, Indus, Godavery, Kistna, Amazons, La Plata, Orinoco, San Francisco, and Magdalena.

And of this amount 3,947 cubic miles are poured into the Atlantic and its partially enclosed seas. This total discharge is to the total rainfall on the land of the globe as 1 to 4.499.

In a subsequent paper the amount of matter in solution and suspension carried from the land to the sea by rivers in the course of one year will be discussed in some detail. At present it may be stated that the analyses of nineteen rivers have been taken as representing on an average the composition of river water. It will be seen by reference to Table VII. that according to these analyses each cubic mile of river water which reaches the sea carries with it 762,587 tons of dissolved matter.

The amount of water draining from the land in the course of a year is, as we have seen, 6,524 cubic miles. At the above rate this would give for matter in solution carried by the rivers from the land in one year 4,974,967,588 tons.

For the purposes of comparison, Table VIII. is given to show the matter in solution in a cubic mile of sea water.

I have to acknowledge the assistance of Mr. James Chumley and Mr. John Gunn in making the calculations in this paper.

TABLE I.—Showing the RAINFALL on the land of the Globe, arranged in continents and islands, with the estimated total amount in cubic feet and miles.¹

AFRICA.		
Inches.	Sq. Eng. Miles.	Cubic Feet.
Under 10, ...	3,221,000	37,414,583,300,000
10-25, ...	2,450,600	102,476,730,000,000
25-50, ...	2,740,900	241,967,530,000,000
50-75, ...	2,562,850	375,090,082,500,000
Over 75 { [mean, 100], . .	201,300	46,767,666,600,000
{ [„ 110], . .	209,050	53,422,370,830,000
	11,385,700	857,138,963,230,000
MADAGASCAR.		
Inches.	Sq. Eng. Miles.	Cubic Feet.
10-25, ...	77,400	3,237,765,000,000
25-50, ...	85,200	7,518,538,300,000
50-75, ...	77,400	11,332,177,500,000
	240,000	22,088,780,800,000
EUROPE.		
Inches.	Sq. Eng. Miles.	Cubic Feet.
Under 10, ...	139,350	1,615,181,250,000
10-25, ...	2,547,350	106,524,600,000,000
25-50, ...	967,850	85,441,258,300,000
50-75 { [mean, 60], . .	50,350	7,015,080,000,000
{ [„ 63], . .	81,300	11,898,705,000,000
	3,786,200	212,494,824,550,000

¹ In these tables, the mean taken in the calculations where the rainfall was under 10 inches was 5 inches, 10 to 25 was 18 inches, 25 to 50 was 38 inches, 50 to 75 was 63 inches. When other means were taken, these are stated in the table within brackets.

ASIA.

Inches.	Sq. Eng. Miles.	Cubic Feet.	
Under 10, ...	5,892,250	68,442,830,000,000	
10-25, ...	6,651,000	278,124,900,000,000	
25-50, ...	2,357,650	208,138,600,000,000	
50-75, ...	890,400	130,319,962,500,000	
Over 75 { [mean, 85], ...	46,450	9,152,530,830,000	
	„ 90], ...	92,900	19,426,500,000,000
	„ 100], ...	7,750	1,798,591,600,000
	„ 120], ...	58,100	16,188,750,000,000
	„ 170], ...	232,300	91,525,308,300,000
	16,228,800	823,117,973,230,000	

JAVA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 110], ...	54,200	13,850,466,600,000

SUMATRA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 130], ...	185,800	56,119,808,300,000

CELEBES.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 120], ...	77,400	21,585,100,000,000

BORNEO.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 100], ...	290,350	67,453,166,000,000

FLORES, Etc.

Inches.	Sq. Eng. Miles.	Cubic Feet.
50-75 [mean, 54], ...	30,950	3,885,217,200,000

PHILIPPINES.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 90], ...	123,900	25,901,445,000,000

FORMOSA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 85], ...	15,500	3,057,811,250,000

JAPAN.

Inches.	Sq. Eng. Miles.	Cubic Feet.
50-75, ...	96,800	14,165,261,250,000
Over 75 [mean, 80], ...	46,450	8,634,000,000,000
	143,250	22,799,261,250,000

SAGHALIEN.

Inches.	Sq. Eng. Miles.	Cubic Feet.
10-25 [mean, 25], ...	38,700	2,257,664,166,000

AUSTRALIA AND TASMANIA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Under 10, . . .	1,196,250	13,896,358,300,000
10-25, . . .	998,800	41,767,350,000,000
25-50, . . .	561,350	49,555,166,000,000
50-75 [mean, 65], . .	247,800	37,413,203,750,000
	3,004,200	142,632,078,050,000

NEW ZEALAND.

Inches.	Sq. Eng. Miles.	Cubic Feet.
25-50 [mean, 36], . .	19,350	1,618,819,500,000
50-75 [„ 60], . .	77,450	10,792,550,000,000
	96,800	12,411,369,500,000

NEW GUINEA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Over 75 [mean, 120], .	340,700	94,974,600,000,000

NORTH AMERICA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Under 10, . . .	1,432,400	16,638,516,600,000
10-25, . . .	2,942,250	123,033,990,000,000
25-50, . . .	2,926,750	258,370,043,300,000
50-75 { [mean, 53], . .	34,850	4,290,119,630,000
{ [„ 60], . .	905,900	126,273,400,000,000
Over { [„ 85], . .	92,900	18,347,250,000,000
{ [„ 90], . .	69,700	14,569,875,000,000
	8,404,750	561,523,194,530,000

GREENLAND.

Inches.	Sq. Eng. Miles.	Cubic Feet.
10-25, . . .	735,550	30,757,845,000,000
25-50, . . .	77,450	6,835,281,600,000
	813,000	37,593,126,600,000

WEST INDIES.

Inches.	Sq. Eng. Miles.	Cubic Feet.
50-75, . . .	85,150	12,465,437,250,000

ICELAND.

Inches.	Sq. Eng. Miles.	Cubic Feet.
25-50, . . .	25,150	2,221,397,600,000
50-75, . . .	9,700	1,416,467,325,000
	34,850	3,637,864,925,000

SOUTH AMERICA.

Inches.	Sq. Eng. Miles.	Cubic Feet.
Under 10, . . .	331,050	3,868,537,500,000
{ 10-25 [mean, 25], . .	483,900	28,105,416,600,000
{ 10-25, . . .	189,700	7,932,267,000,000
25-50, . . .	623,300	55,033,360,000,000
50-75, . . .	3,979,750	582,478,050,000,000
Over 75 { [mean, 100], . .	185,800	43,169,083,300,000
{ [„ 120], . .	1,122,700	312,986,300,000,000
{ [„ 130], . .	135,500	40,922,580,830,000
	7,053,700	1,074,495,595,230,000

ANTARCTIC CONTINENT.

Inches.	Sq. Eng. Miles.	Cubic Feet.
25-50 [mean, 30], .	3,565,550	248,497,500,000,000

SUMMARY.

Continent.	Area in Square Miles.	Rainfall in Cubic Feet.	Cubic Feet per Sq. Mile.	Total Rain in Cubic Miles.
Africa, . . .	11,385,700	857,138,963,230,000	75,280,170	5,822.9
Madagascar, . . .	240,000	22,088,780,800,000	92,037,500	150.1
Europe, . . .	3,786,200	212,494,824,550,000	56,122,230	1,443.5
Asia, . . .	16,228,800	823,117,973,230,000	50,719,080	5,591.8
Java, . . .	54,200	13,850,466,600,000	255,535,000	94.1
Sumatra, . . .	185,800	56,119,808,300,000	302,045,200	381.2
Celebes, . . .	77,400	21,585,100,000,000	278,876,000	146.6
Borneo, . . .	290,350	67,453,166,000,000	232,316,200	458.2
Flores, etc., . . .	30,950	3,885,217,200,000	125,531,500	26.4
Philippines, . . .	123,900	25,901,445,000,000	209,047,600	175.9
Formosa, . . .	15,500	3,057,811,250,000	197,277,400	20.8
Japan, . . .	143,250	22,799,261,250,000	159,155,300	154.9
Saghalien, . . .	38,700	2,257,664,166,000	58,338,500	15.3
Australia, etc., . . .	3,004,200	142,632,078,050,000	47,476,870	968.9
New Zealand, . . .	96,800	12,411,369,500,000	128,212,800	84.3
New Guinea, . . .	340,700	94,974,600,000,000	278,761,300	645.2
S. America, . . .	7,053,700	1,074,495,595,230,000	152,331,400	7,299.6
N. America, . . .	8,404,750	561,523,194,530,000	66,810,230	3,814.7
W. Indies, . . .	85,150	12,465,437,250,000	146,388,700	84.7
Greenland, . . .	813,000	37,593,126,600,000	46,239,860	255.4
Iceland, . . .	34,850	3,637,864,925,000	104,387,400	24.7
Antarctic Cont. . .	3,565,550	248,497,500,000,000	69,695,700	1,688.2
Total, . . .	55,999,450	4,319,981,247,661,000		29,347.4

TABLE II.—Showing the Amount of Land with a Rainfall of under 10 inches, from 10 to 25 inches, 25 to 50, 50 to 75, and over 75 inches, with the estimated total rainfall annually in cubic miles:—

Inches.	Area in Square Miles.	Rainfall in Cubic Feet.	Cubic Feet per Sq. Mile.	Total Rain in Cubic Miles.
Under 10	12,214,250	141,876,006,950,000	11,615,360	963.8
10-25	17,115,350	723,579,725,100,000	42,277,540	4,915.6
25-50	13,958,250	1,165,886,389,600,000	83,529,160	7,920.3
50-75	9,138,350	1,329,977,326,405,000	145,541,300	9,035.3
Over 75	3,588,750	959,853,204,440,000	267,464,550	6,520.7

TABLE III.—Showing Rainfall on land of the Globe, arranged according to Drainage Areas of the great Oceans and Inland Drainage Areas, with estimated total amount falling on each area annually in cubic miles :—

	Area in Square Miles.	Rainfall in Cubic Feet.	Cubic Feet per Sq. Mile.	Total Rain in Cubic Miles.
Atlantic, . . .	14,296,950	1,747,914,843,010,000	122,256,400	11,874.3
Mediterranean, &c.	2,969,350	235,232,989,130,000	79,220,700	1,598.0
Baltic, . . .	611,700	25,938,068,160,000	42,403,140	176.2
Arctic, . . .	8,660,250	314,981,821,300,000	36,371,000	2,139.8
Pacific, . . .	7,579,250	737,040,260,334,000	97,245,100	5,007.1
Indian, . . .	6,813,600	644,577,278,906,000	94,600,500	4,378.9
Antarctic, . . .	3,565,550	248,497,500,000,000	69,695,700	1,688.2
Inland areas, . .	11,486,350	329,988,431,000,000	28,729,760	2,241.8

TABLE IV.—Giving in detail the Rainfall on the various Inland Drainage Areas of the World, with the total amount on each in cubic miles :—

	Area in Square Miles.	Rainfall in Cubic Feet.	Cubic Feet per Sq. Mile.	Total Rain in Cubic Miles.
Sahara, . . .	3,449,400	107,303,672,766,000	31,106,860	728.9
Kalahari, . . .	61,950	2,122,520,830,000	34,261,500	14.4
Abyssinia, . . .	50,300	5,566,944,191,000	110,673,900	37.8
S. America, . . .	507,150	24,642,452,000,000	48,589,180	167.4
N. America, . . .	274,850	12,815,735,765,000	46,629,080	87.1
Eural-Asia, . . .	5,598,000	140,465,518,330,000	25,125,040	955.5
Australia, . . .	1,544,700	37,051,899,600,000	23,986,540	251.7

TABLE V.—Showing Amount of Land, annual Rainfall in cubic feet and cubic miles, and cubic feet per square mile, for each 10° of Latitude :—

Latitudes.	Area in Square Miles.	Rainfall in Cubic Feet.	Cubic Feet per Sq. Mile.	Total Rain in Cubic Miles.
80°—90° N.	85,150	2,625,992,830,000	30,839,685	17.8
70°—80° N.	1,211,800	39,099,401,750,000	32,265,220	265.6
60°—70° N.	5,067,650	172,135,024,166,000	33,966,770	1,177.5
50°—60° N.	5,578,600	278,789,202,127,000	49,974,910	1,893.9
40°—50° N.	6,298,750	325,773,402,376,000	51,720,200	2,213.1
30°—40° N.	5,872,850	296,230,537,993,000	50,441,010	2,012.4
20°—30° N.	5,892,250	363,010,621,876,000	61,608,560	2,466.1
10°—20° N.	4,537,250	394,354,254,321,000	86,914,840	2,679.0
0°—10° N.	3,879,100	697,061,826,883,000	179,696,350	4,735.5
0°—10° S.	4,064,950	699,776,286,345,000	172,151,800	4,753.9
10°—20° S.	3,670,100	411,798,546,467,000	112,204,000	2,797.5
20°—30° S.	3,584,900	214,790,710,656,000	59,915,210	1,459.2
30°—40° S.	1,502,050	95,663,938,508,000	63,691,070	649.9
40°—50° S.	383,250	36,922,903,223,000	96,341,800	250.8
50°—60° S.	77,450	7,378,860,083,000	95,273,090	50.1
60°—90° S.	3,565,550	248,497,500,000,000	90,604,400	1,688.2

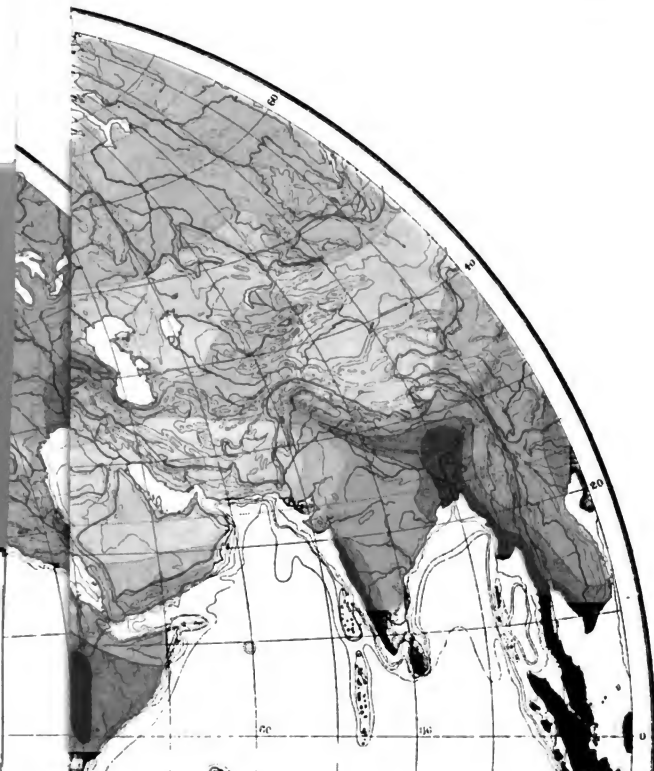
TABLE VI.—Showing the Drainage Area, annual Rainfall, annual charge, and Ratio of Discharge to Rainfall, of 33 rivers in different parts of the world.

Position of Mouth of River.	River.	Drainage Area in Sq. Miles.	Annual Rain-fall in Cubic Miles.	Mean Annual Discharge in Cubic Miles.	M. R.
50°—60° N.	Rhine, ...	32,600	19,500	10,100	2
	Oder, ...	51,100	14,700	2,500	2
	Niemen, ...	36,450	10,355	3,783	2
	Vistula, ...	65,800	19,908	5,657	2
40°—50° N.	St. Lawrence, ...	565,200	338,967	87,312	2
	Danube, ...	320,300	198,736	67,511	2
	Po, ...	27,100	23,887	13,322	1
	Volga, ...	592,300	152,384	43,736	1
	Seine, ...	23,250	10,266	5,469	1
	Rhone, ...	34,850	22,439	14,066	1
	Dnieper, ...	197,450	56,093	22,195	2
	Loire, ...	42,600	18,210	7,810	2
	Dniester, ...	30,950	8,792	3,274	2
	Yang-tse-kiang, ...	689,100	408,872	125,043	3
30°—40° N.	Hoang-ho, ...	387,150	117,711	28,591	3
	Nile, ...	1,293,050	892,120	24,334	3
	Pei-ho, ...	65,000	22,354	1,650	1
	Mississippi, ...	1,285,300	673,064	125,603	1
20°—30° N.	Rio Grande, ...	232,300	113,655	12,676	1
	Indus, ...	360,050	104,416	26,032	1
	Ganges, ...	588,450	548,791	43,263	1
10°—20° N.	Magdalena, ...	92,900	116,746	59,451	1
	Irawadi, ...	181,950	180,849	82,299	1
	Kistna, ...	81,300	61,025	14,776	1
	Godavery, ...	154,850	95,924	16,841	1
0°—10° N.	Orinoco, ...	429,700	603,397	122,242	1
Equator.	Amazon, ...	2,229,900	2,833,830	527,951	1
0°—10° S.	San Francisco, ...	212,900	218,459	22,197	1
	Congo, ...	1,540,800	1,213,044	419,291	1
20°—30° S.	Orange, ...	267,150	50,913	21,875	1
30°—40° S.	Olifant, ...	14,300	2,472	0,679	1
	De la Plata, ...	994,900	904,687	188,740	1
	Uruguay, ...	151,000	130,890	32,136	1
Total		13,272,000	10,186,460	2,182,485	

TABLE VII.—Showing Dissolved Matter in one cubic mile of average River Water, the acids and bases being combined according to the principles indicated by Bunsen.

	Tons per cubic mile
Calcium carbonate (CaCO_3), ...	326,710
Magnesium carbonate (MgCO_3), ...	112,870
Calcium phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$), ...	2,913
Calcium sulphate (CaSO_4), ...	34,361
Sodium sulphate (Na_2SO_4), ...	31,805
Potassium sulphate (K_2SO_4), ...	20,358
Sodium nitrate (NaNO_3), ...	26,800
Sodium chloride (NaCl), ...	16,657

76^u



	Tons per cubic mile.
Lithium chloride (LiCl), ...	2,462
Ammonium chloride (NH ₄ Cl), ...	1,030
Silica (SiO ₂), ...	74,577
Ferric oxide (Fe ₂ O ₃), ...	13,006
Alumina (Al ₂ O ₃), ...	14,315
Manganese oxide (Mn ₂ O ₃), ...	5,703
Organic matter, ...	79,020
For rivers—Total dissolved matter, ...	762,587

TABLE VIII.—Showing Matter Dissolved in one cubic mile of Sea Water, the acids and bases being combined according to Dittmar.

	Tons per cubic mile.
Magnesium carbonate (MgCO ₃), ...	438,000
Calcium sulphate (CaSO ₄), ...	6,147,000
Potassium sulphate (K ₂ SO ₄), ...	3,723,000
Sodium chloride (NaCl), ...	117,441,000
Magnesium chloride (MgCl) ₂ , ...	16,419,000
Magnesium sulphate (MgSO ₄), ...	6,529,000
Magnesium bromide (MgBr ₂), ...	328,000
For sea water—Total dissolved matter, ...	151,025,000

A cubic mile of fresh water weighs about 4,205,650,000 tons. A cubic mile of ocean water (density 1.026) weighs 4,315,000,000 tons.

BLACK AND MEDITERRANEAN SEAS.

AN interesting paper on the currents between these two bodies of water, and the interchanges that take place between them, is given in the twelfth part of the *Annalen der Hydrographie und Maritimen Meteorologie*, for 1886. The first part of the paper treats of the variations in the level of the Black Sea, based upon observations made at eight stations on its north and east coasts, and spread over a period of eight to ten years. These observations have been worked up by E. von Maydell, whose treatment of the subject is the original source of the following remarks. The second, and much the longer, part of the same paper is occupied with a discussion of the inter-relations obtaining between the waters of the Black Sea and the Sea of Marmora; the observations which have furnished the materials for this discussion were made by Captain Makarof, of the Russian Imperial warship *Tamanj*, in the Bosphorus and the adjacent parts of the two seas in question, his labours extending from November 1881 to August 1882.

With respect to the level of the Black Sea, Herr von Maydell deduces the conclusion that there is not only a series of regular annual fluctuations, but also variations of a somewhat more permanent character, making themselves felt at irregular intervals. These last, however, stand in apparently intimate relation to the variations in the amount of

precipitation in the countries drained by the river-feeders of the sea. Taking first the regular annual fluctuations—the level attains its maximum, at all stations alike, in May or June; at those stations which lie in proximity to the embouchure of a great river, the highest point is reached in the middle of May, at the other stations in June. The maximum rise attains to from 9 to 17 cm. above the mean level, which is equivalent to a rise of 3·543 to 6·693 inches. In summer the level falls, until in July and August it is equivalent to the mean of the year. There are two minimum levels during the twelve months, viz., in October and February, when the surface falls from 6 to 10 cm. (2·362 to 3·937 inches) below the mean annual level. These two periods of minimum height are separated by a secondary maximum in December, which, however, fails to reach the mean of the year. In the case of the greater non-periodical fluctuations, it seems that from 1874 to 1879 the surface rose permanently to the extent of 19 to 36 cm. (7·480 to 14·174 inches). In 1880 it sank again; in 1881 it again rose to a maximum; and in the following year once more descended to a minimum. Again, in 1878, a small secondary minimum made itself felt at the mouth of the Dniester, at that of the Dnieper, in the sea of Azoff, and in the Straits of Kertch—that is, in the outlet of the Don. Comparing these fluctuations with the amount of precipitation which fell in the drainage basins of the Russian rivers, a fairly exact correspondence is established between the two: a heavy precipitation in those regions is followed by a rise in the level of the Black Sea, and a light precipitation by a sinking in its level.

Captain Makarof's observations dealt with the density, the temperature of the water, and the interrelated currents of the two seas, Black and Marmora (*i.e.* the Mediterranean). Succinctly stated,—there is a surface or upper current flowing from the former to the latter, which is counter-balanced to some extent by a lower or submarine current flowing in the opposite direction. The surface current follows for the most part the sinuosities of the coasts, recoiling alternately from side to side, according as it encounters projections or promontories on the shores; in the little bays it splits up into cross or counter currents, which continually vary in their relations to the principal current. The rate of flow attained by this last is not uniform, but changes relatively to the width of the Bosphorus; its maximum velocity is about 2 mètres ($6\frac{1}{2}$ feet) per second, or nearly $4\frac{1}{2}$ miles an hour, its average rate being about half this. This current likewise has two series of fluctuations—one yearly, the other daily: it flows strongest in summer, and every day from ten to twelve o'clock A.M. Probably this circumstance of an increase in the rate of flow in the morning depends upon the north-east wind, which blows strongest by day, and abates considerably in force when night comes. The upper current is caused by the difference between the levels of the two seas. Although this difference has not indeed been established by direct measurement, it is inferred to exist in consequence of the difference that obtains between the densities of the two masses of water; and on this basis it is

estimated by Makarof to amount to 22·048 inches. Since the Black Sea receives annually from the large rivers which flow into it a greater quantity of water than is evaporated during the course of the year, it results that there is an absolute augmentation in its mass, causing a difference between its level and that of the Sea of Marmora, and so giving rise to the surface current into the latter. The existence of the submarine current was ascertained both by divers and by density measurements. It too, like the surface current, alternates from side to side of the straits, but does not follow a course parallel or corresponding to the current which pursues the opposite direction above it. The submarine current is originated as the consequence of pressure—the more saline and heavier waters of the Sea of Marmora exercising, in comparison with the waters of the Black Sea, a greater pressure, bulk for bulk, than the latter. Now, were it not for the perpetual augmentation of the Black Sea by the vast inflow of fresh water from the large rivers which drain into it, the natural tendency would be for the two opposing currents to bring about in course of time a condition of tolerably stable equilibrium between the two seas, the denser strata of water sinking to the bottom, whilst the lighter strata would remain on the top. But there is something more than this. The periodical increments of fresh water which come to augment the mass of the Black Sea do not spread themselves out over its surface in an intact stratum, so to speak, but they mingle with the bulk of the salt water. Consequently the surface stream flowing into the Sea of Marmora is continually feeding it with new supplies of saline matter carried from the waters of the Black Sea. This, again, by increasing the density of the water in the former, strengthens the cause to which the submarine current owes its existence. Moreover, the submarine current not only carries back into the Black Sea an additional supply of water, but it furnishes it with an additional supply of saline matter. Thus there is a double interchange constantly going on, always tending towards equilibrium, but never attaining it. Makarof, assuming that the two currents carry with them an equivalent amount of saline matter, estimates the mean density of the upper current at 1·01534, and that of the submarine current at 1·02834. Hence the two masses of moving water, represented by these two currents respectively, are to one another in the proportion 1·847 : 1. Furthermore, taking the vertical section of the currents into account in conjunction with their mean rate of flow, he calculates that the surface current pours into the Sea of Marmora 371,920 cubic feet of water in the second, whereas the Black Sea receives by the submarine current 201,324 cubic feet a second. Starting from this difference of 170,596 cubic feet per second, it is easy to calculate that the absolute amount of water received annually by the Sea of Marmora must be equivalent to a cubic mass whose side measures 94·392 miles. Whilst the upper stream flows at its maximum rate on the surface, and diminishes in speed with increasing depth, the submarine current flows fastest about 18 feet below the common plane of junction between the two, where the

rate of flow is at a minimum. At Sarai-Burnu, near Constantinople, $17\frac{1}{2}$ miles from the Black Sea, the plane of separation lies $65\frac{1}{2}$ feet below the surface; also $65\frac{1}{2}$ feet below this plane, and not quite $6\frac{1}{2}$ feet above the sea-bed, the velocity of the submarine current varied from 1·837 to ·754 feet per second, its average rate being 1·214 feet per second.

The common plane which demarcates one current from the other is by no means horizontal, but inclines steeply towards the Black Sea, as the following table shows:—

Locality.	Distance from Black Sea : Miles.	Depth of Common Plane below surface : Feet.	Depth of Upper Plane of water with Density	
			Under 1·020 ft.	Under 1·025 ft.
Anatoli Beacon, . . .	0	164	147 $\frac{1}{2}$	160 $\frac{3}{4}$
Bujukdere, ...	5 $\frac{1}{2}$	141	128	137 $\frac{3}{4}$
Anatoli-Hissari, . . .	12 $\frac{1}{2}$	118	108 $\frac{1}{2}$	121 $\frac{1}{2}$
Arnaut-Koi, ...	14 $\frac{1}{2}$	137 $\frac{3}{4}$	82	88 $\frac{1}{2}$
Constantinople, . . .	18 $\frac{3}{4}$	65 $\frac{1}{2}$	72	78 $\frac{3}{4}$

The season, too, has an influence in determining the position of the common plane of demarcation between the currents. For instance, at Bujukdere the upper plane of water, with a density less than 1·0225, which at this point coincides with the common plane of separation of the currents, was in the middle of June 141 feet below the surface, in the beginning of July 136 feet, at the end of July 132 $\frac{3}{4}$, and at the end of August 113 $\frac{3}{4}$ feet. These fluctuations seem to correspond with those which take place in the level of the Black Sea, the plane of separation between the currents being lowest when the surface of the Black Sea stands highest. For the higher the Black Sea, the less is the difference in pressure, bulk for bulk, between it and the Sea of Marmora, and consequently the weaker is the submarine current and the deeper its upper surface sinks, while on the other hand, the surface current is then naturally strongest, and consequently extends to a greater depth. J. T. B.

THE PLACE-NAMES OF IONA.

BY ALEXANDER CARMICHAEL.

SAINT COLUMBA came from Ireland accompanied by twelve disciples, whose names are mentioned. The old Gaelic Life of the Saint says that one hundred and forty brethren came with him, namely :—twenty bishops, forty priests, thirty deacons, and fifty students.

“His company was forty priests,
Twenty bishops of noble worth ;
For psalm-singing, without dispute,
Thirty deacons, fifty youths.”

It is not quite clear where Columba landed on arriving in Alban. Some writers think that he landed on Colonsey, an island on the west

coast of Argyll, where it is said his companions raised a cairn called Carn Cul Ri Eirinn—"the cairn with the back to Erin." Others believe that he landed on Oransey, an adjoining island.

This is an example of men apparently disagreeing in opinion, while, in reality, their opinions are substantially the same—their seeming difference arising from both overlooking important considerations. Writers on this subject confine themselves to the present relative position of Oransey and Colonsey. They overlook geological changes which have occurred in the relative position of sea and land along the western coast during the thirteen centuries that have elapsed since Columba's time—changes in which the islands in question have shared. The space between Colonsey and Oransey is dry when the tide is out, those two contiguous islands then being one. Geological indications, amounting to moral certainties, show that a narrow neck of land of the nature of an *aoi* existed between Colonsey and Oransey in Columba's time. Since that period attrition or subsidence, or both combined, have converted this low sandy isthmus into a strait, and the island of Colonsey into two islands.¹

In the time of Columba, Oransey presumably formed a peninsula (Gaelic, *ui-nis*, *aoi-nis*—literally, "isthmus-peninsula") to Colonsey, much as Caipnis forms a peninsula to Harris; as Airdmhanuis forms a peninsula to Tarransey; and as Eignis forms a peninsula to Lews,—all in process of becoming islands as stated in the previous paper. Probably the island of Oransey became disjoined from its mainland of Colonsey in the same way as the island of h-Eisgeir became disjoined from its mainland of Uist; as the island of Seilley became disjoined from its mainland of h-Eisgeir; and as the island of Tarransey became disjoined from its mainland of Harris.

These are theories which the writer believes in as certainties. If they are correct, those who think Columba landed in Colonsey, and those who believe that he landed in Oransey, practically agree, seeing that these two adjoining islands were one island, under one name, in the time of the Saint.

On finding that Ireland was still in sight, Columba left Colonsey and continued his course northwards. On reaching the small island of Iona, adjoining the large island of Mull, Columba and his companions landed. This was on Whitsun-Eve, the 12th day of May, in the year 563, and in the forty-second year of Columba's age.

¹ Oransey = Oran's *Aoi*, Oran's isthmus, sometimes peninsula: Colonsey = Colum's *Aoi*, Columba's isthmus. Saint Oran is said to have lived in the time of St. Columba, and to have come over from Ireland with him. It is possible that when nearing the then united islands of Colonsey and Oransey, a party under Oran was sent ashore on that end of the island which has now become the small island of Oransey. Columba and his party seem to have landed on what is now Colonsey. The islands must have been joined at one time before "*aoi*" would be applied to what are now islands. In olden times, when a saint had any connection with a place, it was usually named after him, and churches built and dedicated to him. So the ruins on Colonsey and Oransey were probably churches dedicated to Columba and Oran.—A. F. C. [The writer's eldest boy is responsible for this note.—A. C.]

CARN CUL RI EIRINN.

To the west of the bay, where Columba landed, is a series of low rounded hills, commanding an extensive view, called Uchdanan, "breasts." Columba ascended the highest of these hills, and tried to see Ireland, but failed. The venerated Saint might have said in the touching words of the modern poet—

"I sigh for Scotia's shore, and I gaze across the sea,
But I canna get a blink o' my ain countrie."

When he found that Ireland could no longer be seen, the Saint, turning to his companions, said, "I have now turned my back upon Ireland, and all that is dear to me therein: henceforth Alban is Ireland to me." Then his disciples gathered stones together, and raised a cairn on the place whereon he stood, and they called the cairn, Carn Cul Ri Eirinn—"The cairn with the back to Erin." And those simple stones are there still, and that simple cairn is still called Carn Cul Ri Eirinn. And he who can look on that memorial heap of stones, overgrown with moss and hoary with age, unmoved and unconcerned, is not to be envied.

PORT A CHURACH.

Port a Churaich, "Port of the Curach," "Port of the Coracle." This is an open bay, more correctly a creek, on the south end of Iona. It was here that Columba and his companions landed on their arrival in the island. Hence the name. The place is greatly exposed to the Atlantic storms, which constantly throw up on the beach, from the depths beyond, small beautiful pebbles of various colours, much prized by tourists as souvenirs of the island.

AN CURACH.

An Curach, "the Curach;" *Curach Chalumchille*, "the Curach of Calumchille;" *Imir a Churaich*, the "Mound of the Curach." These are the names indifferently applied to a green, grassy, oblong mound above *Port a Churaich*.

On ascertaining that he was now out of sight of Ireland, and in order to remove the temptation of going back to the land he loved so well, Columba is said to have buried his curach under this mound. The mound measures 60 feet long, and 10 feet broad, with upright stones sunk into the ground at either end, representing the length and breadth of the curach.

In 1878 a cutting was made across this mound by a noble Highlander, warmly interested in the people and antiquities of Iona, as he is in all things which concern the happiness and the honour of his Highland countrymen. The object of the trench was to see if any trace of the curach could be found. The cutting was shallow, nowhere deeper than the level of the ground on either side of the mound, the excavator being unwilling to go deeper. But no trace of the curach was discovered; nor is it probable that it could—however deep the cutting and however

extensive the search—considering the disintegrating nature of the soil in which the curach was buried, and the perishable nature of the materials of which it was constructed.

The framework (Gaelic, *crannadhail*) of the ancient curach was made of wicker-work, covered over with raw hide, horse-hide being preferable. The modern curach is made of lathes covered with canvas, rendered impervious by paint or tar.

There is no keel to the curach, the bottom being semi-cylindrical or barrel-shaped, like the bottom of a coble. The stem and stern rise free of the water like those of a Norwegian skiff, while the centre is deeply depressed like that of a Spanish galleon. The Irish name *corach*, “crank,” accurately describes the character of this boat. When the weak and crank nature of the craft in which they sailed, and the wide and stormy nature of the sea which they traversed, are considered, it is not surprising to find every now and then in the annals of the period “the death by drowning” of the devoted brethren, in their venturesome voyages to and fro between Iona and Ireland.

The curach is still used in Achill Island, and on other parts of the Irish coast. It is also used on the river Dee, and on other rivers in England. The writer is not aware of any place in Scotland where the curach is, or has lately been, used. The name, however, is current in the old Gaelic poetry of the old people of the Western Isles, as :—

“Cha’n fhaic mi bata no curach,
O thir a mhurain a seoladh.”

“I see neither boat nor *curach*
From the land of Uist sailing.”

The sea-bent, the Gaelic *muran*, the *Arundo arenaria* of Linnæus grows abundantly on the Uist machairs. On this account the people of neighbouring and less favoured islands occasionally, and in derision, call Uist *Tir a Mhurain*, “the land of the bent grass;” and the people themselves, *Na Muranaich*, “the people of the bent grass”—a term which the Uist people resent!

The following quatrain is from an old poem, ten or twelve different versions of which the writer took down from old people in various parts of the Western Isles. The old people call the poem “The Lay of the Maiden;” in Macpherson’s translations it is called Fainesoluis, “The Sunbeam.” The poem is very beautiful and evidently very old :—

“La dhuinn air bheagan sluaigh,
Aig Easruadh nan eidheann chrann,
Chunnacas a tigh’nn air lear,
Curach corr agus bean ann.”

Close translation—

“Upon a day when we were but few,
At the ruddy waterfall of the ivy-clad trees,
There was seen coming on the ocean
A trim *curach* with a woman therein.”

A rock in the sea on the east side of Barra is called An Curachan, "the coracle," from its resemblance to a boat. In the tales of King Arthur and his Knights of the Round Table, the curach is called "*currack*," a small ship."

AN CABHAN CUILDEACH.

An Cabhan Cuildeach, "the round dwelling of the Culdee." Cabhan or cobhan has many meanings, as, a field, a plain, a hollow, a hollow plain, a box, an ark, a coffer, a chariot, a coffin, a round dry bare hill, a circle, anything circular, as *an cabhan cuibhleach*, "a rock," as in,

"Lay by your rock, lay by your reel,
Your win'ing and your spinning wheel."

Cuildeach.—This word appears under many forms and various meanings, all however converging toward one central idea. *Cuildeach*, from *cuil*, "a recess;" *cuildeach*, "the man of the recess;" *cuildeach*—or, as the word is occasionally pronounced by old people in the isles, *cuide-each*—"the recess man of God." The word in all its stages and modifications is less expressive than in the original form of *Celed*, "God-communer." This was the name applied to Columcille and his fellow-workers, as found in manuscripts of the period.

CNOC AINGIL.

Cnoc Aingil is usually rendered "the angel knoll." Adamnan says that angels came to speak to Columba on this knoll, and accordingly he Latinises the name into *Colliculus Angelorum*.

He tells that, during a season of great drought, he and the brethren brought out the white tunic in which Columba died, and, after carrying it in procession three times round the Angel Knoll, chanting the psalms, and reading the books written by the Saint, the heavens suddenly became overcast with clouds, and plentiful rain came down.

Conceding with reverence that angels may have come to speak to Columba on this Knoll of Angels, as they came to speak to Daniel, Zachariah, Mary, and John, the probability is nevertheless that the mound was invested with the name of Cnoc Aingil long before Columba's time. The name is not an unfrequent place-name in the Highlands and Islands.

Besides Cnoc Aingil in Iona, there is a Cnoc Aingil in Kintail; a Cnoc Aingil in Lochaber; a Cnoc Aingil in Lismore; and a Cnoc Aingil in Islay; and elsewhere, though these are all that the writer can remember at present.

Cnoc Aingil in Lismore is an artificial cairn of stones, broad at the base, rapidly tapering towards the top, and from 20 to 25 feet high. It is clothed with short green sward, like the natural hillocks near it, indicating great age. Cnoc Aingil in Iona was a flattish mound, about 50 feet wide at the base, and 15 feet high, when measured in 1876. The other places of the name, known to the writer, resemble these more or less.

Aingeal means angel; it also means fire, glowing fire, flaming fire; light, sunlight. Another form of the word, common in the Outer Isles, is *Ain*, *Aine*, fire, bright fire, red fire; and a third form of the word is *Ainneal*, good fire, glowing fire.

Mr. Dugald Mackechnie, Advocate-Depute, tells the writer that, in his native island of Jura, the word *Aingeal* is applied to the hearth rather than to the fire on the hearth. This is the sense in which the Scotch word *engle*, *ingle*, is applied—a word evidently derived from the same source.

Mr. Hector Maclean of Islay is of opinion that Cnoc Aingil in Islay was used in olden times for lighting vessels into Lochindaal. Mr. Maclean's name and great scholarship are so familiar to all who take an interest in British topography, ethnology, languages, and other kindred subjects, that the writer mentions his own opinion with much diffidence. Nevertheless, his belief is that Cnoc Aingil, wherever situated, and whatever the Cnoc Aingil in Islay may have become afterwards, was a place for fire-worship, sun-worship, and other religious rites in Pagan times.

There are many allusions, direct and indirect, in the old oral literature of the Gaelic people to Druids, Druidism, fire-worship, sun-worship, and other Pagan ceremonies. It may be assumed that most people know that these rites prevailed over the British Isles in ancient Pagan times. It may not be generally known, however, that traces of these, more or less distinct, can still be found in various parts of Britain—in the south of England as in the north of Scotland, on the east coast as on the west coast, and in Ireland. Ancient customs and religious rites are tenacious, and linger long, often after people have ceased to know the meaning and significance of the observances they practise.

In Cornwall the people carry the corpse sunwise round the place of burial, before they enter. In Caithness they do the same. But neither in Cornwall nor in Caithness could the people tell the writer why they practised this observance, except that "it was an old custom." The fowlers of the Flannan Isles walk sunwise round the Flannan Temple, before they begin to kill the birds; while the barristers of the Inner Temple dance in a circle sunwise, at their festival, once a year. The learned lawyers of the Inner Temple, in London, however, are equally as unable to tell why they do this as are the unlearned crofters of the Flannan Temple, in Lews.

The figures and hieroglyphics on the ancient sculptured stones of Scotland now can only be explained by comparing them with similar symbols and living ceremonies on the plains and hills of Hindustan. Those who are interested in this subject would do well to consult a remarkable work—called *History of Paganism in Caledonia*, by T. A. Wise, M.D.

Certain archaic excavations are common to stones in the Highlands of Scotland and to stones in the Forum of ancient Rome. But neither the ancient traditions of the Highlands nor the ancient history of Rome can throw light, beyond the faintest, on these curious cup-like cuttings. He

who would ascertain their meaning on the plains of Uist and in the Forum of Rome, must see analogous customs still practised in the East, in India, China, and Japan. Mr. William Jolly, with an energy and an industry altogether his own, has collected a large mass of the most curious materials on this subject.

The most curious church known to the writer is at Harris. The building is cruciform, and of the twelfth century or thereabout. It was burnt twice, and remained a roofless ruin for long years till it was restored a short time ago by the late Countess-Dowager of Dunmore, whose noble presence and nobler deeds of wisdom, benevolence, and beneficence will long live in the grateful hearts of her warmly-loved Harris people. The church contains some beautifully sculptured tombs of the Macleods of Harris and Skye, a family much beloved by their people. Attached to this church is a square tower, which the old people of the place say is much older than the church. They call this tower *Tur Chliamain*, (Saint) Clement's Tower—a name they never apply to the church. There are many sculptures on the tower. One of these figures is that of a man in a kilt, entirely like the kilt as at present worn—thus proving beyond question that the present make of the kilt is as old as this old tower. The naked figures of men and women, beasts and reptiles, adorn or unadorn, as the spectator may think, the old tower of the church. The writer asked the people of the place, clergymen who conducted services in the church, and others, the meaning of these figures and symbols, but to no purpose. One Catholic priest, now a Protestant minister, told him that he saw similar symbols and figures on an old church in Spain, but what their meaning, there no one could tell. The naked figures, however, are representations of ancient Phallic worship.

In this one building the ancient heathen rite and the modern Christian ceremony meet, the new having been added on to the old. Instead of "pulling down the rookeries to dislodge the rooks," the early Celtic missionaries, wisely or unwisely, engrafted their own evergreen branching religion on the widely-rooted stem of the old. The Phallic customs of ancient Britain are still practised in Asiatic and Mongolian countries.

"I saw on my right hand, on a small hill, a small circle of stones and a little cairn in the midst, evidently Druidical, but called the Hill of the Angels—*Cnoc-nan-Aingeal*, from a tradition that the holy man (Columba) had there a conference with those celestial beings soon after his arrival. Bishop Pocock informed me that the natives were accustomed to bring their horses to this circle at the feast of St. Michael, and to course round it. I conjecture that this originated from the custom of blessing their horses in the days of superstition, when the priests and the holy-water pot were called in; but in later times the horses are still assembled, but the reason forgotten."—Pennant's *Tour—Visit to Iona*, 10th July 1772.

These are examples of men and communities adhering to ancient customs after they have ceased to know the meaning of the customs they practise.

Cnoc Aingil is occasionally called Sithean, "fairy knoll," and Sithean Mor, "large fairy knoll." This name is common, and is still associated by Highland nurses and Highland children with beautiful fairies dressed in green, delightful fairy dances, and bright fairy *illuminations*. The descriptions are always bright and realistic.

The people of Iona hold their horse races and games at Cnoc Aingil, on the 29th September, being the festival of St. Michael, who is, or rather was, the patron saint of horses and of horsemen throughout the Highlands and Western Isles. Horse-racing and games exhibiting feats of strength, agility, and endurance, under the most trying conditions, were common in every parish and island. These races and games lingered longest in the Isles, in some of which they only fell into disuse in recent years. When the chiefs ceased to reside among their people, and to show a paternal interest in their pleasures and pastimes, in their joys and sorrows, the old games and sports of the Highlands declined. Most—not all—of the new men, whether as proprietors or as factors, who took the place of the chiefs too often and too successfully, from their pride of purse or arrogance of power, exercised a depressing influence, morally and physically, over the people. An old Highlander very justly might address his absent old chief in the words of Pitcairn :—

"New people fill the land, now thou art gone,
New gods the temples, and new kings the throne."

EARLY SCOTTISH GEOGRAPHY.

I.

IN these papers it is not proposed to go into the ancient Geography of Scotland. It would no doubt be of great interest to discuss the first rude sketch of Ptolemy, and trace its correction and development in the *Scotia Antiqua* of Gordon of Straloch. The maps in the old collections of Bertius and Hornius and Brietius would have to be examined, and all the dreadful controversy which arose from Camden's supposed heresies on this subject, and in which Maul, Hume, Drummond, Craig, Buchanan, and other patriots took part, would have to be narrated. Writing in 1710, Sir Robert Sibbald says, "These jars are at an end a good while since." Sibbald did not, and could not, foresee that this controversy would be largely superseded by more fundamental questions. The learning of that period is largely summed up in the additions which Sibbald made to Camden's *Scotia* and in his independent treatise in MSS., of which the titles were printed in his *Account of the Writers of Scotland as it was of Old*. But however important and interesting the ancient geography of Scotland may be, it is more a field for ethnological speculation than anything else. Nor can it be said that the earlier descriptive writers, who come down to a later time, such as Fordun and John

Major, add much to our distinct knowledge of the country. An advance is made by Hector Boece in his *Regni Descriptio*, which, as the Bishop of Carlisle has pointed out, is a good deal altered in the free translations of Bellenden and Harrison. It was also translated into French by Desmontier. Some paragraphs may here be given from Harrison's translation of Boece :—

"Whatever we have generally spoken of Albion, that is chiefly to be understood of the Scottes, and farre greater, especially among the Scottes, as they call them in the Highlands, as people that have lesse to do with foraine merchants, and therefore are less delicate and not so much corrupted with strange bloud and alliaunce. Hereby, in like sorte, it cometh to passe, that they are more herde of constitution of body, to beare off the colde blastes, to watche better and absteyne long, whereunto it also appeareth that they are bolde, nimble, and thereto more skillful in the warres. As for their faith and promise, they hold it with greatest constancie. Towards the Almeine Sea, I find that Scotland hath the Mers, sometimes the most plenteous region of the Pictes, for their marche, which, so long as the sayd people did inhabite it, was called Deera or Dere; but after their expulsion it was called Mers, that is to say, the merches or limites of their country. In processe of time also the Scottes extended their boundes even into ye Twede, which now divided Northumberland from the Mers. On the other side of the country, towarde the west, sundry small bournes descend from the Cheviot Hilles, and other mounteynes lying thereabout, into the Solwe, dividing Cumberland from Annandale, and so being brought into one chanel, they fall together into the wide ocean, and stande for the boundes of Scotland upon that half of the countrey. The Cheviot hilles are in like sorte taken for the Middle Merches of the countrey, whiche, with certain small brokes that fall from the same, do separate both the countreys, whereby their limites are known. The Mers hath under marches at several places, whither it is extended, as sometime the Germaine Sea, sometime East Lothian, sometime the Twede, and sometime the Forth."

Mixed up with a great deal of fabulous nonsense, though the element is less prominent than in the works of Major and Fordun, there are many most interesting statements bearing on the civilisation of the time. Thus, we are told that in Dumfries many fine cloths, especially white, are made, which are brought up and carried into England, France, Flanders, and Germany, where they are had in great price and estimation. The Water of Clyde, again, is described as dividing Lennox on the north side from the barony of Renfrew, and as arising out of the same hill in Caledon Wood, from whence the Annand falleth. Loch Lomond has thirty islands well replenished with churches and dwelling-houses, and is remarkable for three things,—1st, a very pleasant and delicate fish without fins; 2d, that the water of the Loch will often swell with great waves, though no wind be stirring; 3d, a pasture island which fleeteth hither and thither as the wind bloweth. In Loch Fyne there is more plenty of herring than in any part of the coast that compasseth the island. In Argyll there are many rich mines full of metal, but the people have no skill to find or try out the same. Lochaber is also said to be rich in mines of iron and lead. Inverlochy is described as formerly the haunt

of French and Spanish merchants. The constant report also goes there that there is a stone of such nature that if it be hidden in straw for a certain season, it will kindle of itself and consume the straw to ashes. In Dundee it is said the people travail very painfully about weaving and making of cloth. In the Vale of Esk the sheep have such fine excellent and white wool that the like is hardly to be found within the whole island. The Mearns are described as having a very fat soil, full of pasture and abundantly replenished with every sort of cattle. In Fife all manner of grain grows plentifully, and where there is no corn, there is no less foison for cattle. Black stones are digged out of the ground, which are very good for firing; and such is their intolerable heat that they resolve and melt iron, and therefore are very profitable to smiths and other artificers. These black stones were not at this time found except between the Tay and the Tyne. In Fife also salt is made in great quantities by boiling sea-water. The Forth is described as being plentifully indued with cockles, oysters, mussels, seals, whales, pellocks, and great foison of white fish. In the middle of the Isle of May there is said to spring up a fountain of clear and fresh water; and the Bass appears as a wonderful crag, rising within the sea, whereunto is so strict and narrow a passage that a man shall hardly come unto it by a fisher boat, and thereto but at one place. The solan geese are said to bring such a store of sticks and boughs together for their nests in spring that the same suffice the keepers of the Castle for the yearly maintenance of their fuel. The keepers are said also to take the fish captured by the geese, and also the young geese. In the bowels of these geese there is said to be a grease which is of singular force in medicine; and when the skin and fat are flayed from their bodies an oil is obtained which is very profitable for the gout and other diseases in the haunches and groins of mankind. Lothian, we are told, for bounty of soil, is not inferior to any region in Scotland. It has many towns, but Edinburgh passes them all, as well in policy of regiment as in form of building and in the wisdom and riches of its inhabitants. The famous Maiden's Castle and the King's chief Palace triple the renown of this great city. The oily spring of St. Catherine's is mentioned, and is strongly recommended for cankers. Dunbar, by natural situation and also by the industry of man, is said to have become one of the chief holds in Albion. Going north again, the Don and the Dee are praised for the greatest store of salmon to be found in the compass of Albion, and likewise the "greatest and longest, if you respect their quantity." Ross is described as almost impossible to travel on the west by reason of the high mountains, and more apt for wild beasts than mankind to inhabit. On the east, however, it lends itself to culture and grazing, and the well-watered valleys are remarkable for a sweet and savoury grass, with which all sorts of cattle are much delighted. Strathnaver is remarkable only for its three great crags or points, shooting far into the sea; but Sutherland is a profitable region for grain and all kinds of provisions, but

chiefly for the nourishment of bestial. Turning southwards again, the Spey is said to run with such invincible force as to beat back the sea at flood-tide. The River and Loch Ness are both declared to have the remarkable property of never freezing, and even of dissolving frozen substances which are thrown into them, and of restoring to animation benumbed cattle. Of Inverness, it is recorded that great abundance of herring was formerly taken, but now they are gone "by the secret working of God." For this departure of the herring, however, the common people blamed the indiscriminate slaughter of the fish by the men of high calling. In the woods about Loch Ness there was great store of hart, wild horses, roes, martens, foxes, beavers, and weasels, whose skins and cases are sold to strangers at huge and excessive prices. In Moray, there are not only all kinds of grain, but also nuts and apples; and at Loch Spynie there is the wonderful brood of swans, which feed on a peculiar herb growing in the lake. Great praise is given to the whiteness and fineness of the wool of the sheep of Buchan. In the district of Slains a wonderful stalagmite cave is described, and it is said that oats grow in many places without culture or tillage. Glasgow is celebrated not only for St. Mungo's Church, and a University, where the liberal sciences are zealously taught, but for its mines of gold and azure, rubies and diamonds being sometimes found. At Stirling began the great Caledon Wood which runs through Menteith and Strathearn to Atholl and Lochaber, and in which the wild white bulls with curled manes used to be found; but these bulls at the date of the narrative were only to be found near Cumbernauld. Stermond or Stormonth is said to be plentifully indued with grass and corn. The soil of Athole is said to be bountiful, and it yields corn without tillage; in particular, the fields of Lude, if well tilled and dressed, yield great store of barley without sowing any seed. In other parts of this district, however, the soil has the extraordinary property of turning wheat into rye. As to the islands on the west, Islay is said to be a rich parcel, 30 miles in length, full of coin and metal, "if the people were cunning to find and trim the same." The description of the Western Islands, however, is extremely confused.

As Sir Robert Sibbald observes, the history of Bishop Leslie with the first complete map of Scotland, marks a great improvement on the crude and credulous narrative of Boece. The great work of Buchanan, in spite of the severe animadversions of Gordon of Straloch, is again written from a more sceptical and reliable standpoint than that of the Bishop, and includes Donald Monro's account of the islands.

Buchanan's writings are supposed, through the medium of Andrew Melvin, to have furnished much of the Scottish matter in the great Atlas of Blaeu. The next great name is that of Timothy Pont, the eldest son of Mr. Robert Pont, minister of St. Cuthbert's Church, Edinburgh. He was a systematic geographer, working under the limitations of his time. He travelled over the country for the purpose of making maps and recording descriptions. The original draft of the maps were mostly done

by his own hands, although the maps themselves were made by Gordon of Straloch and others. Pont took careful notes of distances, and marked down the products of each place, as well as the antiquities of the locality. His description or *Topography of Cuningham* is cited by Sibbald as the most complete specimen of his style. To this we shall afterwards refer.

In the meantime, we propose to give some account of the *Description of Scotland* by Bishop Leslie. Leslie published his history at Rome in 1578, and the interesting translation of his book from Latin into Scottish by Father James Dalrymple, religious in the Scottish Cloister of Ratisbon, first made in 1596, has just been edited for the Scottish Text Society by the Rev. Father Cody. Curiously enough, Leslie measures the length of Britain from a certain village in England, beside Cornwall, named Winchester, to the farthest part of Caithness, sometime called Carnau, about 700,000 paces. Observing upon Cæsar's account of the Scottish climate, Leslie says that the air is thicker, and there are more clouds than in France. The north winds are vehement, but he thinks they prevent sickness, and make the country more wholesome. The result is that although we have much snow and cold wet weather, the "sweat" of Britain never entered Scotland. The day, which in Cornwall has only seventeen hours, in Edinburgh has eighteen, and in Orkney nineteen. For two months, indeed, in Ross, Caithness, and Orkney, the beams of the sun are seen all night, so that people can see to read and write. Generally speaking, although the writer is here treating of Britain as a whole, the land is extremely fruitful, bearing everything the common use requires, except spice and wine, and some fruits, which are largely imported. Leslie hints, however, that there might be more labour and industry. In the high country, oats is more prosperous than wheat. All the north of England, and the greater part of Scotland, use a very good bread made with great labour from oats. A most wholesome drink called ale, is made from bere, but this is better in England, where it is brown from the use of hops. The Merch ale is the best, and is sometimes kept for five or seven years, and is so good that foreign nations think it from colour and taste to be Malmsey. The greatest part of the island has excellent pasture for all sorts of stock, but the hilly portions have a very thin grass. The fine wool of the sheep has greatly assisted the art of cloth-making. The forests yield timber, and are remarkable for their great stock of deer. The supply of fish is so great and well known that nothing need be said about it. Tin, lead, gold, and iron are all found, but apparently not in large quantities. The singular observation is made, that very little has been done to defend the towns of Scotland by walls, because the Scots have learned to defend themselves by the force of body and the strength of mind. The Forth, Clyde, Tay, Dee, Don, and Spey are the only ship-bearing rivers in Scotland which he mentions. The general division of the country he makes is worth quoting: "One part lying to the south is much birthfuller through fertility of the ground, and nobility of the blood there, and more

populous, more courtesy, gentle in behaviour, humanity of life, civility of manners." The other "quarter lies to the north, which by the river of Tay towards the east is separate from the south part. But, albeit the north part be horrible in respect of the mountain Grampius and other rough, sharp, and hard hills, full of moss, moor, and morass. Notwithstanding, in this part are some provinces so plentiful and of greater ingines, that through their policy they are either to many in the south compair, or they excel many in the south." Proceeding to speak of the particular districts of Scotland, Leslie says that the Merse and Teviotdale are both plentiful in corn, money, and men of war. There being little wood, however, reeds or straw are used for firing. Berwick is described as a fine and strong town. Duns is mentioned as the birthplace of Duns Scotus, the Subtle Doctor, and Dunglass is said to have a beautifully decorated collegiate church. He congratulates Teviotdale on the fact that for thirty years since the first beginnings of the Reformation the revenues of its monasteries have not been violated by the laws. He makes the strange blunder of stating that the Esk runs into the Tweed. Referring to Annandale, he remarks that our countrymen give the name of dales to valleys, and sometimes the name is used as equivalent to portions. In the west and north of the Water of Forth either a proper name or the generic *strath* is used. Dumfries is complimented on the fineness of its cloth, and its inhabitants are said to be all horsemen, ready for encounters with the English. Both Upper and Lower Galloway have fertile ground and much pasture, and are famed for white wool and for ambling or pacing horses, which excel all other horses by many days journey, and are preferred to bigger animals. Among other seaports the White Case is mentioned, and it is pointed out that the greater part of the country is given up to the Church, as at Glen Cluden, Glen Luce, and St. Ninian's, Sweetheart, etc. The sea-lochs are said to abound in herring, oysters, and other fish, but mostly in fish that breed among stones. Passing north to Ayr, or, as he calls it, Silurie, attention is called to the number of knights and barons, "whom we call my lords," living there, and the number of fenced castles, although there are many more country houses and clachans. There is no finer cheese than here, and butter in great quantity. There are a great many bee-hives; more oats and bere than wheat. Strange nations are said often to arrive at the port of Ayr. There is not much wood, but more as you go to Clydesdale. At Renfrew there is such a fishing of salmon in the Clyde that sixty boats may often be seen both in spring and in summer. Paisley is situated among knowes, greenwoods, shaws and forest; and the good Bishop becomes eloquent in praise of the rich and magnificent monastery here, and the ashlar bridge which leads to it over the river. Govan is commended for its good ale, which was known through the whole land. Glasgow is the most renowned market in all the west. It sends to the east countries very fat cattle, herring and salmon, ox-hides, wool, skins, butter and cheese; to the west it sends corn; to the Hebrides and Argyll, and even to Ireland, it sends

wine, ale, mead, and aqua vitæ. Round Glasgow are a great many garden herbs, apple trees, and orchards. Little ships come to Glasgow Bridge, ten miles from the sea. The land round Glasgow all belongs to the Archbishop, and the rents have not been raised for a thousand years. The gold mine or gold strand in Crawfordmuir is mentioned. In Tweeddale there are men known to have 500, 800, or even 1000 sheep. These horned sheep are small, and with short tails, but their flesh is as tender as that of cattle fed in the South country. Peebles is a noble town, to which frequent pilgrimages are made. There is a gold mine in Meggetland, and the forest is here crowded with harts. Lothian, sometimes called Pentland, is then described as the chief province for fertility and fine houses. He speaks of such gems as pearls, rubies, diamonds, and lapis lazuli being found in Lothian, as well as elsewhere. In the account of Edinburgh he cannot forbear the observation that, although the nunnery of the Sciennes was purest of all from suspicion, it was the second building in Scotland destroyed by the "adversary." Stirling is just as fertile as Lothian, and has abundance of salmon. It is noted for peas and beans, and has plenty fuel, which is oddly described as "eldine of fyre, quither ye wisse it war of moss, trie, or stane." Stirling Castle is thought to be not so strong as the Maiden Castle of Edinburgh, on account of Demyat standing opposite. The *Mons Dolorosus* is called the Mountain of Sturte, or Snawdoun. The Tor Wood is described as extending from Callander and Calder to Lochaber, and Menteith is commended for its cheese. Going to the Lennox country, the Castle of Dumbarton is quaintly described as "lyke a lang peir sett in a round aple, and put in the nuik of a round table." In the multitude and excellence of its fish, Loch Fyne seems even then to have been pre-eminent. Argyll, except in parts of Knapdale, is said to be very unmeet for corn, except in some glens, but fit enough for deer and wild cattle. The flesh of these wild cattle is highly praised, and seems to have been much used, the best kind being in Carrick. Down there, the cow-calfes only are kept on the farm, the bulls, after being fed in summer, are sold fat at winter time, and generally killed and salted, as the Scottish people never cared much for salt pork. Proceeding with his account of the Argyll country, Leslie gives a high character for fertility to both Lorn and Kintyre, but the relative positions of these districts it is impossible to reconcile with the maps of the time. "Beyond Lorn, the land, as it were in disdain, is driven to a straight and great narrowness, extending itself to the Highland seas, of a certain great peninsula, 60 miles or thereabout in length, with floods flowing round about, and watery ways even so of the sea, which bounds they now call Kintyre." The passage to Ireland is stated at 16 miles. Perth and Fife are both given a high character for fertility, the observations of Boece on agriculture in Athole being repeated. "Stane coles" are abundant in Fife, and are used, among other things, in the making of white salt, of which there is also a factory on the brae on the Lothian side. The composition of peat or turf used for fire causes the learned writer no little astonishment. He speaks of

the 6, 7, or 8 cubits depth of fat mossy ground, like glue, with great stocks and blocks of oak and other trees, some rotten through age, but others quite fit for building, not in the least worm-eaten. He cannot understand how trees ever grew in such barren places, or how, since they must have grown, the earth came to be raised over them in this way. He concludes that there must have been a great forest before the Deluge, and that the matter deposited by the flood gradually hardened into the earth, now used as peat. Going north again to Lochaber, Leslie records that the people there do no justice to their fine river salmon-fishings, because they will not let strangers come to help in catching the fish, but desire to keep all for themselves. He also repeats the statement of Boece that East Ross is famous for fat cattle, and adds that many falcons, spar-hawks, and eagles are found there. The capercaillie, called by the vulgar the horse of the forest; a bird with rough feet and red breast, called "the cock that builds in places hard and difficult to come to," viz. the grouse: the black cock, which lives on the small blades of trefoil; the great gustard; the partridge; the laverock, of which twelve can be got for a French sou; the crane; and the heron, are all plentiful in Scotland; but we have few pheasants, storks, turtle doves, fieldfares, or nightingales. In Lochbroom, Ross-shire, there is a miraculous quantity of herring. Twenty years before it had been still greater, and the French, Flemish, and English fishermen were coming regularly there for these fish; the decrease of herring was considered a divine punishment for bloodshed. Generally, the best winter fishing for herring is on the Clyde and the lochs there, especially Loch Fyne, where the fish are fatter and more savoury than elsewhere; later on the fishing begins south at Carrick and Galloway, and on the east about Fife. Leslie doubts if anywhere in the world there is more variety or abundance, or greater cheapness, of fish than in Scotland. Among others he mentions turbot, fluke, plaice, mackerel, cod, perch, and oysters, buckies, and other shellfish among the stones. The historiographers, we are told, called the Firth of Cromarty the port of safeguard and safety. Dingwall is reported to have great wealth of salmon. Red Castle and the Tower of Lovat are mentioned as being even at that time ancient keeps. The method of catching fish in long wicker creels is practised at the famous ford called the Stockford of the Ross. In Sutherland the land is very convenient for feeding cattle and wild deer; "quhair through the rentis to the possessours is the mair profitable and sueit, quhen through the less labour and expenses the ground provydes quhat is sufficient for them, frilie as it war." The Bishop, when he gets near home, may be pardoned for a little enthusiasm. Here is his description of Moray. It is a country alone by all the rest commended with us for both plenty and pleasure. For it is even and plain, without dubs or mires, marvellous delectable in fair forests, in thick woods, in sweet and sairing flowers, well-smelling herbs, pleasant meadows, fine wheat, and all kind of stuff, orchards and fruitful gardens, and then so near the coast. There is the air most wholesome,

incorrupt, temperate, clouds and rain much less than in any other place, and therefore great increase of corn. And, afterwards, he speaks of the fertility of the ground, the clemency of the heaven, and the gentleness of the weather. In this happy land, which modern doctors call the Riviera of Scotland, we must for the present leave Bishop Leslie.

OBITUARY, 1886.

ROBERT FLEGEL, the German explorer, who gained great distinction by his numerous voyages (1875-1880) on the Lower Niger, and by his exploration of the upper course of the Benué and the high table-lands of the Adamawa, died on the 11th of September at Brass, a station at the mouth of the Niger.

PAUL SOLEILLET, who was born at Nîmes in 1842, died at Aden, on the 10th of September, of a disease contracted in the course of his African explorations—a work to which he had devoted his lifetime. His memorable journey into the Sahara, in the course of which he penetrated to the oasis of Ain-Salah, was made in the years 1873-74. Thereafter he formed the design of travelling from Senegal to Algeria by way of Timbuctu, but he was not allowed by the French Government to go beyond the borders of Senegal. His next enterprise had for its object to open up Shoa, a small Abyssinian kingdom, to French commerce. He therefore left France, to which he had returned from Senegal, for Obock, installed himself at Sagallo, and proceeded thence to the residence of King Menelik, to whom he pointed out the advantages that would accrue from his entering into relations with the French factories on the Red Sea. He made several journeys from Shoa to the Red Sea, and also into the interior parts of Abyssinia, and has published accounts of these in three separate works.

At Paris, on the 3d of November, died M. FELIX BELLY, who, in 1856, attempted to cut through Central America (at Lake Nicaragua), and was the first who had ever made such an attempt. The project was revived two years later, but fell through. M. Belly was a contributor to several French journals and reviews, and also to the *Revue de Belgique*, in which he published a remarkable study, entitled "The Seven Wonders of the World." Besides being a talented writer, he took the initiative in several important undertakings, and was remarkable for the energy with which he prosecuted whatever scheme he took in hand.

At Innsbruck, on the 14th of August, died PROFESSOR B. JÜLG, a high authority on the Mongol-Kalmuk languages, with which he had been familiar from his youth. He was Professor of Classical Philology in Innsbruck University.

The lamented death of Dr. G. A. FISCHER, distinguished for his explorations in Eastern Africa, took place at Berlin on the 11th of November last. Having settled in 1876 as a physician in Zanzibar, he made from thence occasional excursions, both along the coast and into the interior of the country. His first journey was made in 1877, and extended along the coast as far north as Vitu. In the following year, he ascended the Dana to Massa, and, in the course of this expedition, halted for a time at Kau on the river Osi. About the end of 1882, he set out from Pangani with the intention of advancing to the Victoria Nyanza and Samburu Lakes, but, owing to illness and the opposition of the Masai, he was forced to retrace his steps when he had penetrated as far as Lake

Naivasha. Since his route lay between the more easterly route taken by Mr. Thomson and the more westerly taken by Mr. Stanley, he added an important contribution to our knowledge of that part of the country. On the 2d of August 1885, he again left Pangani, being now in command of an expedition intrusted to him by Herr Junker for the rescue of his brother, who was supposed at that time to be with Emin Pasha. In January he reached Kagehi, at the southern extremity of the Victoria Nyanza, where he learned that the route through Uganda was closed. He therefore proceeded along the eastern shore of the lake, and eventually reached the Baringo Lake. But this was the limit of his progress. The country was ravaged by famine, his resources were exhausted, and further supplies were not procurable. He was, therefore, most reluctantly forced to abandon his enterprise, and to return to the coast. Dr. Fischer unfortunately has published comparatively few records of his observations and discoveries. In 1885, however, two volumes from his pen appeared,—*Das Masai Land*, in which he gave an account of his first journey to the Masai country, and *Mehr Licht im dunklen Weltteil*.

ADMIRAL BEDFORD C. T. PIM, R.N., a daring Arctic explorer, distinguished for his energetic advocacy of the project for connecting the Nicaragua Lake with the Mexican Gulf by means of a railway line, died on the 30th of September last. He was born at Bideford, Devonshire, in the year 1826. At the age of sixteen he entered the Royal Navy, and while serving under Captain H. Kellett, in H.M.S. *Herald* (1845-1851), took part in the search for Sir John Franklin by way of Behring's Straits. After his promotion to the rank of Lieutenant he formed the plan of an expedition to search for the lost ships of the Franklin expedition along the shores of Siberia. The Czar Nicholas, however, refused his sanction to this enterprise, and Pim therefore joined the search expedition, commanded by Sir E. Belcher, in the year 1852. In the course of this service, he crossed on the ice from the *Resolute*, one of the searching vessels, on the east, to the *Investigator*, under Captain R. Maclure, on the west, and thus earned the distinction of having in a manner accomplished the North-West Passage. After this he was engaged in the Crimean war, and subsequently in the hostile operations against China, in the course of which he was severely wounded. His services were rewarded by his being promoted to the rank of Commander. Towards the end of 1858 he visited the Isthmus of Suez, and wrote a paper on the proposed Suez Canal, which was read and discussed at length at a meeting of the Royal Geographical Society. Shortly afterwards he was appointed to the command of the *Gorgon*, and was sent to the West Indies and Central America, for the purpose, among others, of protecting the Republic of Nicaragua against the filibusters led by General Walker. It was while engaged in this service that he entered warmly into the question of inter-oceanic transit across Nicaragua. In 1861 he retired from active service on half-pay, and two years afterwards returned to Central America, in order to explore the line of route for the projected railway, for which he had formerly found a suitable terminus at "Pim's Bay," 35 miles north from Greytown, on the Mexican Gulf. This project, as is well known, eventually failed. In 1868 the subject of our notice was advanced to the rank of Captain, and two years afterwards finally retired from the naval service. He then applied himself to the study of law, and in 1873 was called to the bar. In the following year he entered Parliament as member for Gravesend, which he represented till the dissolution in 1880. Thereafter he travelled much in North America. Among other works, he wrote *The Gate of the Pacific*, *The Negro and Jamaica*, *Jottings on the Roadside in Panama*.

Nicaragua, and *Mosquito*. In 1852 he was elected a Fellow of the Royal Geographical Society—to the journal of which for November last we are indebted for the foregoing particulars—and last year he became a member of the Scottish Geographical Society.

LIEUTENANT PALAT, who started in October 1885 from Algiers, in order to reach Timbuctu through the Sahara, was assassinated by his guides in the oasis of Tidikelt, near Ain-salah, a station in the Tuareg country. This was not far from the place where the Flatters expedition was massacred some few years ago. The murder of the unfortunate Lieutenant was perpetrated on the 8th of March. The French Government has been urged to send an expedition against the Tuareg tribes, to prevent the recurrence of such incidents.

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

AN Ordinary Meeting of the Society was held in the Masonic Hall, Edinburgh, on the evening of 24th January. The Lord Provost of Edinburgh, Vice-President, was in the chair. Colonel Sir Francis de Winton, *Ex-Administrator-General* of the Congo Free State, read a paper on "The Congo: its Past and Present," which will be published in a subsequent number of the Magazine.

On the conclusion of the paper, Mr. Eddie, a missionary who had spent three years on the Congo, addressed a few remarks to the meeting. Dr. Macgregor moved, and Sir Alexander Christison seconded, the vote of thanks to the lecturer, and Mr. A. L. Bruce paid a similar compliment to the chairman.

Colonel Sir Francis de Winton read the same paper, on Wednesday the 26th January, before the Glasgow Branch of the Society, in the Hall of the Philosophical Society, Bath Street. Mr. W. Renny Watson presided, and Dr. Thomas Muir moved the vote of thanks to the lecturer.

GEOGRAPHICAL NOTES.

EUROPE.

Iceland.—Dr. Thoroddsen, the Icelandic geologist, who in 1882 was commissioned by the Althing to explore the east side of the island, and who two years later paid a visit to the lava waste of Odáthahraun in North Iceland, has, during the past summer, explored the inhospitable and almost impassable parts of the north-west, which are but little known and have only seldom been visited in part since the middle of last century. In July, whilst examining the Breithi Fjord, he was confirmed in the opinion that several glaciers, for instance the Gláva Glacier, are much less extensive than they are represented to be on the maps. In August, under very unfavourable climatic conditions, he traversed the east coast of the island as far as the neighbourhood of the North Cape.

The Topography of the Ancient North Britons and the name Albion.—From the *Scotsman* of 3d January 1887, we extract the following from the pen of Mr. Donald Clark, of Roseneath:—The ancient North Britons had the word *Morbheinn* (great mountains), in early Scotch *Morven*, now obsolete, but still to be seen in the Ossianic poetry—such as Fingal, King of Morven—viz., King of the

Grampians, west of the Druim Albin. And they had Aird na mor bheinn (promontory of the great mountain), now in Gaelic and English Ardnamurchan; also Mor aird (great promontory), now Morairn, and in English Morven, also Morvern (parish of). They had likewise Garbh mhonanin (coarse or rugged hills), called by the Romans Grampus, Grampius, and in English Grampian. The same was called in Celtic Garbh duthaich (coarse or rugged country), and is now rendered in Gaelic Gaidhealtach (Highlands). From this arose Aird na Gaidhealtach (promontory of the Highlands), rendered Arghail, and called by the Romans when in Britain Argathelia, and in English Argyll. From the above we have Gaidheal Daoine (signifying the Highland People), rendered, as seen in old writings, Gaidheilge, Gaidheal, Gadhel, Goidel, Ghael, now Gael (Highlander); and Gaidheal Labhart (signifying the Gael's speech), rendered Gaoidhelge, Gadhelic, Gaodlic, Ghaelic, now Gaelic.

The Name Britain.—From the Celtic word Alpin (signifying mountainous). The Gauls in France, and from the Gauls the Greeks and Romans, in early times called the British Isles Albion, Albyan, Albin, etc., and they called the same Bheinn eilean (mountainous island), which was rendered as now in Gaelic, Breatunn; in Welsh, Prydain; in English, Britain; by the Romans, Britannus; and in English, Britannia.

The early North Britons had the words Ard bheinn (high mountains), and rendered Alpin, Albin, Albainn, etc., now the Celtic name of Scotland; but this originally meant only the hilly part of North Britain, north of the Clyde and Forth; and the inhabitants were called, as they still are in Gaelic, Albannach (Albions), now the Celtic name of the Scotch, but originally meaning only the inhabitants north of the Clyde and Forth; by the Romans, Albanactus. They had also the words Braigh Albin (the uplands or tops of Albin), and rendered Breadalban. About Loch Tay is now called Breadalbane, but Breadalbane proper included Ben Lawers, Ben Macdhu, and the highest points of the Grampians. And they had An druim Albin (the ridge or spine of Albin). This is a ridge of mountains that runs up the centre of Albin, from and including Ben Lomond into Sutherland—so called as being the natural boundary between those on the east and those on the west of the same, each having a king and government of their own. Thus, the hilly part of North Britain, north of the Clyde and Forth, had for long been known by two names put in common—viz., Gaidhealtach (Highlands) and Albin—the name Albin predominating—until Kenneth MacAlpin in 843, at the head of the Fingalian Scots, including the Dalriads, brought all North Britain under one king and government, and the country after that time was called after them Scot's-land (Scotland); and all North Britain was, for the first time in Celtic, called Albin (the Celtic name of Scotland). North of the Clyde and Forth has since been known in Gaelic as Gaidhealtach (Highlands) only. By this time, 843, broad Scotch, or early English, had got into some form in the Lowlands, called in Gaelic Bruidhinn gallt (Lowland speech), and rendered Beurla (the Gaelic name of the English language). North of the Clyde and Forth was thus called in English "high-lands" (Highlands); and its inhabitants "high-landers" (Highlanders).

Thus the Albin of the early Britons included only the hilly part of North Britain north of the Clyde and Forth; and all the inhabitants south of Albin were called Breatunnech (Britons). Those on the border of Albin were called Breatunnech Strath Cluidh (the Britons of Strath Clyde); and their stronghold was called Dun na Breatunnech (Fort of the Britons—viz., Fort of the Britons of Strath Clyde), now Dun Breatun, and in English Dumbarton; by the Romans Castrum Britonum (Fort of the Britons).

Population of Germany.—A census is taken every five years. The population in 1870 was 40,816,240 ; 42,727,360 in 1875 ; 45,234,061 in 1880 ; 49,840,900 in 1885 ; showing a mean annual increase of 400,000 inhabitants, exclusive of the yearly emigration, which is said to exceed 150,000 souls. The population of Prussia, on 1st December 1885, was estimated at 28,318,458, and the population of Berlin, on 12th September last, reached in number 1,340,552 inhabitants.

Bosnia and Herzegovina.—In the *Mittheilungen* of the Vienna Geographical Society, No 11, 1886, there is a paper by Dr. Franz Ritter von Le Monnier on the population of Bosnia and Herzegovina. It is a notable fact that in these countries the female population is much lower than the male, which is in contrast to the proportion found in the rest of Europe. For every thousand persons there are 527·7 men and only 472·3 women. He does not find that the Mohammedan religion exercises any influence upon this proportion.

AFRICA.

Population of Algeria.—The following are the complete results of the census in 1886:—French, 219,627—increase since 1881, 24,209 ; naturalised Jews, 42,595—increase since 1881, 6932 ; Mussulmans, 3,284,762—increase since 1881, 442,265 ; foreigners, 206,212—increase since 1881, 23,838.

Western Sahara Desert.—The expedition under Captain Cervera, despatched by the Madrid Geographical Society, arrived from Africa at Los Palmas, Canary Isles, on 21st August. The expedition left on 16th June last the factory of Rio de Oro, and returned there on 24th July, coming from the Western Sahara, without provisions, without clothes, and in a deplorable condition. They had to endure terrible sufferings in the desert, were several times threatened with death by the natives, and suffered hunger and thirst under a burning sun. The result of their investigations goes to show that the region of Hadrar, which was supposed to be so rich and populous, is nothing more or less than a continuation of the desert, without rivers, having no other inhabitants than the nomad tribes, who live in the greatest poverty.—*Bulletin de la Soc. de Géog. de Marseille*, Tome xi., No. 1.

The Emin Pasha Relief Expedition.—We are glad to state that the expedition for the relief of Emin Pasha, under the leadership of Mr. H. M. Stanley, left London on Friday, 21st January. Mr. Stanley travelled direct to Brindisi, and took the P. and O. steamer for Alexandria, *en route* for Zanzibar. It is his intention to obtain an interview with Dr. Junker, before definitely deciding on the route by which he will conduct his expedition to the Egyptian Equatorial Provinces. We may be sure that Mr. Stanley, from his responsible position, will select the best route for the purposes of his mission ; but he has—wisely we think, especially if it is to be an East Coast route—decided to keep his plans secret. In his published statements, it is true, he showed a preference for the route by the Congo, but it does not at all follow that this route will be the one his expedition will take. His arrangements provide against every contingency, so that every available route—except, perhaps, that by the Lakes, where the transport arrangements are scarcely adequate for so large an expedition as he commands—is open to him. Our readers will be sufficiently informed of the merits or demerits of each route : Dr. Felkin, in his paper published in the December number of our Magazine, set them very clearly before us ; and he subsequently visited London, and conferred with Mr. Stanley on the subject. Of Dr. Felkin's route, it may at least be said that it traverses a less extent of unknown country by some hundreds of miles than any of the others. The advantages claimed by

Mr. Stanley for the route by the Congo were set forth in his speech at the farewell banquet given in his honour on 20th January. Mr. Stanley said :—

“I know if I go to any part of Africa on the East or on the West Coast, and ask the people about an unknown district, they will tell me the longest stories on record as to the people in that unknown land. I never came to the fringe of an unknown district but the people said the individuals in that unknown district were the worst possible people on the face of the earth. If I asked them as to the district between Stanley Pool and Emin Pasha, they would say there was not a worse spot in the whole of Africa. I prefer, however, that unknown hostility to the known hostility which we are sure to encounter through Mwanga's territory, or in that of the murderous Wakedi. The title of the expedition is the ‘Emin Pasha Relief Expedition.’ Emin Pasha has some 1800 soldiers and some 4000 irregulars. All that he requires is powder, and the means to make a proper fight, if attacked. We are supposed to carry him the means that he requires. Suppose he desires to return, or the means to enable him to fight, strengthen his position, and stretch out his influence amongst the Mahdi's people. Why, if that were his desire, and we reach him, then he will have the opportunity of doing so. It would not be much of a relief expedition if I started from the East, say, with ten or twelve tons of cartridges and powder, and I found myself, about two-thirds of the way, bereft of every cartridge. I would simply be adding to the difficulty of Emin Pasha, instead of relieving him. Therefore, those tons of powder and millions of caps are a tremendous anxiety. So I found it necessary to consult my charts and cast a retrospect. When I looked at Masai Land and read Mr. Thomson's book, I came to the conclusion that such a very precious article as gunpowder and cartridges were in danger of being annexed by the first powerful prince I came alongside. Then I might march over that expanse between the Victoria and the Albert. I have studied the characteristics of the people. It is a lovely land ; it is a noble land ; it is a land of which any one might be proud to call himself king. It is rich in cattle, rich in noble men, noble in appearance, for they are great fighters ; and so long as you have got cartridges and powder which you are going to carry to some one beyond, it is a question of the cartridges and the powder, and nothing else. Therefore I came to the conclusion that it would be unsafe to carry that through a country where the best fighting elements might be found. It might be possible to launch boats on the Victoria, and put our cargoes on board, and sail up towards Uganda, and by forming an entrenched camp further on, and by a rapid ten days' march, like charging the buffalo, reach our goal. But in the attempt you risk a great deal. We could only force our way through by an armed force and by strife. But if we did succeed, the missionaries in Uganda would be in danger. There were a French and an English missionary there. The man who was guilty of Bishop Hannington's death, if he heard of this expedition in his territory, would, in his guilty conscience, ask himself, ‘Is this a dagger which I see before me?’ for, no doubt, that chief dreads that some day the Nemesis will break in upon him. Even though I were able to break through that territory, and it resulted in the sacrifice of the missionaries, the expedition would not be a successful one. It was necessary, therefore, to seek another route. Long ago I had my eyes on the Congo, but I felt that the King would not grant permission to use it. He might say, ‘This is a peaceful State, and we cannot allow an armed force to go through it.’ This is what I thought the King would say. I therefore set my charts in order to find a feasible route from the East Coast, when suddenly the King of Belgium summoned me to Brussels. I wondered what it was all for. The King said to me, ‘Why not take the Congo route? you know it very well.’ The King

said what I would have proposed. He said, 'You will have plenty of steamers, and you will have your men fresh and sound, and then you will simply have a month's march. Cannot you take that route?' I replied, 'Certainly, that is the very route I wanted; but I restrained myself.'

The following is Mr Stanley's estimate of the time in which his expedition could pass by the Congo route :—

"If we start on the 25th February, we should do the 5000 miles between Zanzibar and the Congo in twenty days only. Give us five days to go up the Congo and establish our camp. We will be able to march in 17 days more to Stanley Pool; and then we could embark for 30 or 35 days, steaming up the Congo, and establish an intrenched camp. In 117 days we arrive at the southern end of Lake Albert; we launch our boat, taking 40 minutes to screw it up; and in four days probably we come across one of Emin Pasha's steamers. They will see the Egyptian flag on our boat."

Mr Stanley, having been interviewed by a representative of the *Pall Mall Gazette*, is reported to have said :—

"Whichever way we go (whether by the Congo or from Zanzibar) I shall send couriers with despatches until we touch the fringe of the terrible girdle which encloses Emin in its grasp. From the circumference of this circle to its centre is, I estimate, a distance of some 300 to 400 miles. I shall despatch my last couriers from its edge, and before they reach the coast I shall hope to have come up to Emin Bey. You should hear news of us about July.

"Of course Tippo Tip is an old friend of mine. I remember him as a most agreeable and gentlemanly fellow. His story is told in one of my books, but his power and influence have extended enormously since then. His headquarters are at Kasonge. Mwanga must have been a child when I was with Mtesa, his father. He was educated by a Roman Catholic priest, but when he succeeded his father the priests were the first to suffer. One of my difficulties is, that if I trouble him, the missionaries he has in his power (Bishop Hannington was one of his victims) will certainly suffer. He is about twenty now, I should think.

"What is the full strength of the expedition? About a thousand men, all told. Besides myself I have eight Englishmen, the rest of the number is made up of Zanzibaris. Already the caravan has grown beyond my original intention. The estimated cost is £20,000. The preparation has been ordered by cable to Zanzibar, and when we reach there, all should be ready. Each porter carries 60 pounds weight, and I allow each European 180 lb. baggage. We shall depend for our food upon what the villages and our guns supply, taking only such luxuries as tea, coffee, sugar, tobacco, and the things Africa does not yield."

Not only will the expedition carry ample supplies of ammunition and arms for Emin Pasha, but it will be supported by a Maxim and a Nordenfeldt gun. Its first object will be to reach Emin Pasha and give him the help he so urgently requires; after that, the expedition will be free to explore any of the adjacent districts Mr. Stanley may select, and which offer so virgin and valuable a field for geographical discovery.

Our members will be aware of the great interest and practical steps taken by the Council of the Society in the Expedition for Emin Pasha's relief; but it is to the labours of Mr. William Mackinnon, of Balinakill, a Vice-President of our Society, that the organisation of the present expedition is due. Mr. Mackinnon, who guaranteed the whole amount of the money required for the Expedition, and is himself the chief contributor to its funds, has also received the support and co-operation of other members of our Society, who have been placed on his Committee. Two Members of the Council have each contributed the sum of

£500 to the funds of the Expedition, and an ordinary Member of the Society has contributed £1000. The Expedition has also been supported by a grant of £1000 from the Royal Geographical Society; and though the sum already raised now amounts to £20,000 (including the grant by the Egyptian Government), the subscription list is still open, in order that any unforeseen expenses may be promptly met by supplementary funds.

We have only, in taking leave of Mr. Stanley, to wish him "God speed," and a safe return. The Society has more than an ordinary interest in the success of his expedition. Its action has chiefly brought the matter prominently before the public, and secured valuable co-operation; the organisers of the Expedition are intimately related to the Society; and the leader, Mr H. M. Stanley—who inaugurated the Society in Edinburgh, Glasgow, Dundee, and Aberdeen—and his patron, H.M. the King of the Belgians, were the first Honorary Members elected by the Society.

[Mr J. T. Wills, in a recent number of the *Fortnightly Review*, contributed a valuable article on the position of Emin Pasha, which was illustrated by an original map; and in the *Graphic* for January 29th, Dr. Felkin supplied a *Supplement* giving a popular account, illustrated by woodcuts and an excellent map, of Emin Pasha, his work, and of the Expedition sent to his relief. Our readers will obtain much useful information from these contributions.]

Dr. Lenz's Expedition.—Africa has again been crossed from west to east. Dr. Oscar Lenz, the leader of the Austrian Congo Expedition, arrived at Zanzibar on January 15th. He was upwards of a year and a half crossing the continent. He left Banana Point on August 27th, 1885, and reached Stanley Falls Station on March 23d, 1886. Dr. Lenz had intended to explore the Muta Nzige Lake, and also to enter into communication with Emin Pasha and Dr. Junker; but as he does not mention these points in his telegram, we conclude he was unable to carry out his intention.

It seems strange that Dr. Lenz should have been as long getting from Banana Point to Stanley Falls as from Stanley Falls to Zanzibar. This fact does not seem to add to the reputation of the Congo as a rapid route to the interior; but until we have the details of Dr. Lenz's journey, it is premature to express a definite opinion.

Writing on 1st June 1886, Dr. Lenz reported his arrival at Kasonge, the new trade emporium on the Lualaba. He broke up, it will be remembered, on 29th March 1886, from Stanley Falls, with three large canoes and twenty men to work them, placed at his disposal by Tippo-Tip, the slave and ivory sultan of Central Africa. The rapids in the Upper Congo proved to be a great hindrance to navigation; moreover, as it was the season when the river is swollen with water, and its current consequently powerful, the heavy and clumsily-constructed canoes could make but slow headway. The banks were almost entirely deserted, the population, in consequence of the Arab slave-hunting raids, having withdrawn into the denser parts of the forests. Dr. Lenz reached the important trading-station of Kibonge on 15th April, the Arab settlement of Riba-Riba on May 1st, and Nyangwe on May 16th. At each of these places dwell Arab traders from the east coast and from distant Muscat, attracted by the ivory commerce. Nyangwe possesses numerous well-built houses of brick, partly separate steadings surrounded with gardens. Here provisions were cheap, whereas Kasonge, the capital of Tippo-Tip, is a dear place. This town, 2½ hours distant from the Congo, is regularly laid out in streets, and has the appearance of a prosperous town. It is a great rendezvous for ivory and slave caravans, which come in

daily from the north, south, and west. Their excursions extend southwards to Urua, and westwards to Lomami. The Arabs are apparently doing much for the cultivation of the Upper Congo; they have established permanent stations in clearings of the woods, where they grow rice, maize, lemons, onions, pine-apples, etc., so that provisions in those districts are plentiful.

The Lokenje or Mfimi.—An abstract of Lieut. Kund's account of the German Noki Expedition has already been given in this Magazine (vol. ii. p. 296). The report of his colleague, Lieut. Tappenbeck, is printed in the *Verhandlungen d. Gesellsch. f. Erdkunde z. Berlin* (Bd. xiii., No. 10, 4th December 1886). The canoes having been built, the expedition started on its journey down the unknown river it had discovered. At first the stream flowed between masses of large forest trees, the foliage of which stretched down to the water's edge, and completely hid the banks from sight. The river varied from about 1000 to 1650 feet in breadth, and, although making many windings, pursued on the whole a W.S.W. direction. The whole of the upper course of the Lokenje is thickly sprinkled with small islands, on which grow various lofty trees. Owing to the masses of fallen leaves which cover the bed of the stream, its waters are of a very dark green colour. The islands which stud the river and its banks all along swarmed with grey parrots and bats; and mosquitoes were plentiful. The banks were for the most part of a swampy nature, and bordered with forests. On the second day the stream bent in a W.N.W. direction. All along its left bank the travellers observed numerous landing-places for canoes, but the right bank appeared to be destitute of human inhabitants. On the third day a change began to make itself felt. The Lokenje turned north-westwards; the forests drew back from the margin of the river, leaving room for a narrow fringe of reed and grass; the islands no longer bore trees, but on several stood little fishing hamlets—mere collections of miserable huts. From the evening of the third day the river underwent a total change, although still flowing, with numerous sinuosities, steadily N.W. Its width increased, and the forests receded further and further from its banks, which were planted with several large and populous villages. These people, who spoke a tongue that was unintelligible to the Loangos of the expedition, are described as being tall and slender in build, with agreeable features. They are skilful canoemen, guiding their canoes—which are 14 or 15 feet long, and run out to a point at either extremity—with admirable ease, by means of a long narrow oar. Each man has his own canoe, which he navigates standing. No pearls or wire, or other objects of European barter, were observed amongst them. They did not, however, manifest any decided hostility, and were not wholly averse to trade. The river soon spread out into a series of lake-like expansions, containing many islands. The forests, too, had by this time given way to reeds and grass, and to the east, visible in the distance, appeared a low range of hills, scantily wooded and skirted by a few copses of the Mateba palm. During the fifth day's journey they first met natives wearing thick metal rings on their arms and legs—sure tokens of a people having some sort of connection with European trading stations. Their language, however, was not understood by the Loangos. Lieut. Tappenbeck is inclined to think they belong to the Bajanzi, who dwell along the lower Kassai or Sankullu (Sankuru), and on the left bank of the Congo, north of Stanley Pool. They are of middle size, stoutly built, and well fed, but have ugly features. They do not, however, indulge in the practice of tattooing, nor do they pierce the nose or ears. Their hair they plait into small queues or tails, which hang down all round the head. The women were short of stature and corpulent, and loaded with masses

of metal rings. On the sixth day the river turned west, and assumed the appearance of a large lake. All along this part of its course the Lokenje swarmed with herds of hippopotami, species of small ducks, herons, geese, storks, snipe, pelicans, flamingoes, ibises, snake-birds, avosets, and jacanas. During the seventh day's travel they passed the embouchure of a river coming from the north, and flowing into the Lokenje in a stream 500 feet wide. This was afterwards found to be the same stream that flows from Lake Leopold. From a village in this neighbourhood it was ascertained that the Lokenje, here called Sadi M'Pidi, joined, some days lower down, the Sadi M'Be, or Kassai, or Sankuru; and also that the steamer *En Avant*, of the Congo Free State, with Dr. Wolff¹ on board, had proceeded thus far up the Lokenje, and then returned. From this point the people, tall and stalwart, beautifully painted a madder-red colour, and wearing their hair thickly plastered with a paste of oil, resin, and red colouring-matter, worked into two stiff buffalo-like horns bent back from their forehead, were nearly all clad in stuffs of European manufacture. The Lokenje, where it joins the Sankuru, is only 650 to 900 feet wide; the latter river pushes huge sand-banks athwart its course, and these forcibly contract its channel. For some distance the waters of both rivers flow on side by side without mingling, those of the Lokenje or Mfini, on the right, being black, and those of the Sankuru yellow. The landscape again undergoes a change: the united streams, called by Wissmann the Kassai, are hemmed in by high, bare, rocky hills; on the south side, however, they leave space for a narrow fringe of wood between their foot and the river. The channel, now swollen to more than 1600 yards wide, is thickly strewn with rocks and sand-banks, which render necessary great caution in the navigation of the river. At length, on the twelfth day, the expedition succeeded in reaching Leopoldville, and eventually Stanley Pool.

Major Carvalho.—The Portuguese expedition, under Major Carvalho, has reached the capital of Muata Yamvo, and has concluded a treaty with the reigning sovereign, by virtue of which the kingdom of Lunda has been placed under the protectorate of the King of Portugal, and a Portuguese Resident will, in future, take up his post there.—*Bulletin de la Soc. de Géog. de Marseille*, Tome xi., No. 1.

Mayotte.—This little island, one of the Comorin group, lies in the Channel of Mozambique, $7\frac{1}{2}$ miles west of Madagascar. In shape it is oblong, its major axis, from north to south, measuring about 25 miles, whilst its width varies from $2\frac{1}{2}$ to $8\frac{1}{2}$ miles. Its area is 135 square miles. The island is traversed from north to south by a chain of hills having peaks ranging from 1840 to 2160 feet high, and growing certain stunted trees. Their flanks are scored by the beds of what become in the rainy season little torrents. The shores are indented with numerous small bays, offering safe anchorages, viz.—Zauzi, the capital of the colony, which is protected at all seasons against the wind; Lugoni, on the north; and Sulu, Shingoni, and Boëni on the west, this last being the most capacious of them all. The climate is healthy, the island being situated within the zone of regular winds and outside the area of hurricanes. The year is divided into two seasons: one, hot and rainy, lasts from October or November until April or May; the other, which is more genial and agreeable, lasts from May to October. The mean temperature of the year is $81^{\circ}5$ Fahr. The only productive object of cultivation is the sugar-cane, which formerly yielded from 24

¹ *Comp.* vol. ii. p. 496-7.

to 40 cwt. per acre, but has since greatly declined. Nevertheless about 3000 tons of sugar are manufactured annually, together with from 17,600 to 19,800 gallons of rum. All the sugar is exported to France, and from 7700 to 8800 gallons of rum; about 3300 gallons are shipped to Madagascar. Attempts are also made to grow vanilla, the annual harvest of which, estimated at 39 cwt., is exported to Europe. The castor-oil plant, the aloe, the cacao, and cotton have been quite recently introduced. The population consists of about 9000 indigenes, who subsist miserably on the little rice they manage to grow, and 216 Europeans, all except three French. Commerce is almost entirely in the hands of natives of Hindustan, who supply the indigenes with cloth stuffs from Zanzibar and Bombay. France sends some machinery, provisions, wines, soap, etc., for the use of the few French settled on the island; and things of a similar nature are likewise procured from Réunion. But it is from Madagascar that the inhabitants of Mayotte get the principal part of the rice and cattle which they require for their sustenance. The island is visited once a month by a regular steam-packet from Réunion, which touches also at Tamatave, Sainte Marie, Nossi-Bé, and proceeds to Zanzibar, and which runs in connection with the boats of the Messageries Maritimes that call at St. Denis (Réunion).—Extracted from *L'Expansion coloniale de France*, by M. J. L. de Lanessan.

AMERICA.

Canada : Survey Operations.—The Surveyor-General of the Department of the Interior says that considerable work has been done by the surveying staff during the past season. The geographical position of several points on the Canadian Pacific Railway in British Columbia has been determined—such as Port Moody, Kamloops, Revelstoke, and Field. This was effected by astronomical observations, and telegraphic communications with Seattle, one of the stations of the United States Geographical and Geodetic Survey. A survey has also been made of the Canadian Pacific Railway, which, when corrected, will be the basis of work in British Columbia. The lines are to be run from either side of the railway. The work in Manitoba and the territories consisted of surveys of the old trails, which are to be established as the main highway. An exploratory survey was made of Lake Winnipeg, and a topographical survey of the Rocky Mountains. The heights of prominent peaks in British Columbia along the line of railway have also been ascertained. Mount Begdee, a glacier mountain, is 7,339 feet above the Canadian Pacific Railway; Mount Klotz, 6,909; Syndicate Peak, 6980 feet above the railway, and 10,700 above the sea; Mount Stephen is 5511 above the railway, and 10,300 feet above the sea.—*Canadian Gazette*, December 23, 1886.

Sources of the Mississippi.—During the present century the country in which are situated the headwaters of this river have been several times explored; for instance, in 1804 by Morrison, in 1832 by Schoolcraft, in 1836 by J. N. Nicollet, in 1846 by C. Lanman, in 1849 by the Ayers, in 1865 by W. Bungo, in 1872 by Julius Chambers, in 1879 by A. H. Siegfried and others, in 1880 and 1881 by W. E. Neal, in May 1881 by Rev. J. B. Gilfillan and Professor Cooke, and in July 1881 by Captain Glazier. Moreover, those districts were surveyed by the United States Government surveyors in September and October 1875. Captain Glazier, as the result of his expedition, claimed to have discovered, south of Lake Itasca, a new lake, which had been unknown previous to the date of his visit. In October 1886 the same region was again examined by Mr. Hopewell Clarke, the result of whose labours has been to substantiate the general

accuracy of the work embodied by Nicollet in his map, as well as that of the Government surveyors, and consequently to disprove the claim set up by Captain Glazier. Lake Itasca, the first important gathering basin for the feeders or sources of the Mississippi, is a sheet of water divided into three narrow arms, resembling roughly the three legs of the mythical Manxman. The south-western arm, which runs in the same direction, is separated at its extremity from another sheet of water, called Elk Lake, by a narrow portage, only 350 feet across at its narrowest part. These lakes have their shores parallel for 1020 feet, and are connected by a creek, varying in width from 6 to 12 feet, and in depth from 2 to 8 inches. Elk Lake has an elevation of 13 inches above Lake Itasca, and is fed by four small streams, all of which originate in springs in the marshy soil that extends around it on the south. In addition to the creek from Elk Lake, the waters of Lake Itasca are augmented by other streams. Of these the most important, and the one best entitled to be called the source of the Mississippi, flows into the lake at its south-west corner, in a current 16 feet wide and $2\frac{1}{2}$ feet deep, to the west of the outlet from Elk Lake. This stream, like the majority in this part of the Mississippi basin, has its origin in numerous springs scattered through the tamarack swamps, and deriving their supplies from the slopes of the hills (20 to 160 feet high) which lie to the south. In its course the stream passes through three small lakes, which had been mentioned by Nicollet, and the lowest of which (that nearest Lake Itasca, about 2 miles distant) is 92 feet above the level of that lake. Another arm of Lake Itasca runs northwards, and from its extremity proceeds the continuation of the Mississippi. The third arm, which runs first east, then south, has only one principal feeder—a shallow stream, which swells to a torrent after heavy rains. The heights which enclose the basin containing these lakes and streams have on the south of Lake Itasca at first a general trend from north-west to south-east, changing almost directly to nearly due east. They send off two spurs to the north, one between Elk Lake and the south-west arm of Lake Itasca on the one side and the south-east arm on the other; the second spur skirts the eastern shore of the last-mentioned arm. Of these two spurs the former slopes gradually from 175 to 75 feet near the lake shore, overlooking the meeting-point of the three arms. The main ridge, or rather succession of hills on the south-west, varies from 250 to 200 feet in height. The bowl enclosed between the north-west prolongation of the main ridge and its westerly spur must be regarded as that from which the Mississippi undoubtedly takes its origin, seeing that the springs in this portion of the general basin are full and perennial, whereas those in the more easterly section, between the two spurs, are variable and at some seasons probably dry.—*Science*, December 24, 1886.

Notes on Travels in South America by Dr. Ten Kate.—This traveller, at the very beginning of the year 1886, was in Guiana. He visited both banks of the Maroni, at four days' distance by water from Paramaribo, for the purpose of studying the Indians. Those whom he found on the Surinam bank are Galibis, that is, true Kalina or Caribs, together with some Arowats. On the French bank of the river there are no Indians, for the Government prohibits them from settling there, owing to the proximity of their colonial penitentiaries, in which are confined transported Arabs and Annamites. The colony of Surinam seemed to Dr. Ten Kate to be in a sad condition. It is entirely neglected, and evidently in a state of great decay. The plantations, especially the sugar plantations, are being abandoned one after the other, and the forests are recovering the ground that cultivation formerly won from them. The population are lazy and destitute

of energy. The predominant type is creoles of every colour ; and Jews form a considerable contingent. Rich and influential Europeans, particularly energetic and competent men, are very rare. Nothing but a new population, full of energy and resolution, and the complete reorganisation of the agricultural and industrial resources of the colony, can raise it from its present deplorable state, for which the mother country and the colony mutually blame each other. After spending a short time in Georgetown and in Trinidad, where he visited the feeble remainders of the indigenous population, scattered through the mountainous parts in the interior, Dr. Ten Kate sailed for Ciudad-Bolivar, in Venezuela. From that town he set out on horseback for Cumana, where he arrived eighteen days later. His route led him at first over hot sandy llanos, across the courses of the rivers Morichal, Tigre, and Guanipa, and afterwards, by almost impassable paths, over the calcareous and schistose sierra. The inhabitants of these tracts are extremely poor, in consequence of the numerous political revolutions of the country, and at that time their miserable state was intensified yet more by the drought that prevailed, and by the swarms of locusts which ravaged their crops of maize and cassava, and their sugar-canes. Cumana no longer answers to the city of Humboldt's day. Great part of it has been overthrown by the earthquakes. During his stay at this town, Dr. Ten Kate visited the Guayqueries Indians, who dwell along the shores of the Gulf of Cariaco, and live by fishing. They are only interesting from the strictly anthropological point of view.—*C. R. de Soc. Géogr. de Paris*, No. 16, 1886.

AUSTRALASIA.

The Sources of the Finke River.—Mr. Charles Chewings contributed to the *Adelaide Observer* an account of his recent journey to the sources of this river, and it has now been published in pamphlet form, accompanied by a large well-executed map. The Finke River drains an extensive district of Central Australia, and Mr. Chewings says its valley has been fixed upon by settlers as "the most favourable country for food and water that could be found." Mr. Chewings set out on his journey from Adelaide in December 1884, and after travelling 5000 miles, chiefly on horseback, returned to Adelaide in December 1885. From what he saw, he came to the conclusion that the far inland tracts of Central Australian pastoral land are by no means, as they have unfortunately been termed, a "desert ;" on the contrary they represent a "very excellently watered and grassed country." Since his first visit in 1881, Central Australia has become much more attractive to the settler. "New stations have been formed, old ones improved, others are in progress, and country hitherto thought a wilderness has turned out to be some of the best watered and finest country in all the north-west. Stock have increased in a way that has surpassed the expectations of the most sanguine." The Finke River is the largest of all the Central Australian watercourses, draining a vast belt of country on either side. There is no part of Central Australia, according to Mr. Chewings, "so well watered, and so certain to weather out the severest droughts as the valley of the Finke. The springs in the ranges may get low, and surface waters dry up, but the Finke never." When we consider the battle Australian settlers have to wage with drought, Mr. Chewings' discovery of a valley where drought may successfully be mastered is one of considerable importance and general interest.

The Rewa River, Island of Viti Levu, Fiji.—Mr. J. P. Thomson, C.E., read a paper on this subject at the meeting of the Queensland Branch of the Geo-

graphical Society of Australasia, in September 1886, and it is published in the *Proceedings* of that Branch, of which Mr. Thomson, we may add, is Hon. Secretary and Treasurer. Mr. Thomson warns the public "to discountenance and ignore all odious newspaper and book reports descriptive of the colony and native race of Fiji," such reports being nearly always the work of persons who had paid only a very brief visit to the islands. He claims the honour of "being the first to write about Fiji for a Geographical Society," and promises that his description shall be accurate. Of course, Mr. Thomson writes from prolonged personal experience of Fiji. The largest river in Fiji is the Rewa, in the island of Viti Levu, the largest island in the group. It is navigable for some 72 miles, and drains a surface area of about 1360 square miles. The soil and climate of the Rewa district are peculiarly adapted for the growth of all tropical and semi-tropical products. "Yams, sweet potatoes, pumpkins, arrow-root, beans, and many kinds of esculents are scattered over the district in great profusion, yielding an abundance; and sugar-cane, maize, cotton, and tobacco attain to almost marvellous proportions of development." The sugar industry is the mainstay of the district, and during the last four years its increase has been wonderful. In 1882 the total sugar export from Fiji was only 1731 tons, value £58,857. In 1885 the export of sugar exceeded 10,586 tons, and the value was £211,729. Sheep do not appear to thrive well in Fiji, but horses, cattle, and goats do. "Pigs are the real pioneers of the colony, and are running wild in the forests and jungle." Lobsters and turtles are plentiful. The natives are a contented and happy family, and are much superior in physical and intellectual capacity to any of their brethren in Polynesia. Prior to their conversion, cannibalism existed among them, but now the Fijians are a civilised, well-behaved, religious, and useful race. Nearly all of them can read and write their own language, and the young are trained at Wesleyan, Roman Catholic, or Government schools. Since the annexation of Fiji, English law has been established there, and prosperity seems general. An admirable map of the Rewa River and its tributaries accompanies Mr. Thomson's paper, which will be justly valued by all desiring information regarding Fiji.

GENERAL.

Government Aid to Scientific Societies.—In quoting, evidently from our report of Mr. Murray's recent address to the Royal Society of Edinburgh, *Nature*, of January 27th, takes exception to some of the statements, thus :—"With regard to London, Mr. Murray, we think, should verify his references, as we know of no Society which receives 'a money grant of considerable value.'" Our report does not profess to give the precise words employed by Mr. Murray, for which the original paper must be consulted, but it gives a perfectly accurate summary of the substance of the address. We may point out, in reply to *Nature's* avowal of ignorance, that the Royal Society of London receives £4000 per annum "to enable the Society to defray the expenses of scientific investigations, undertaken by the advice of a Committee appointed for the purpose;" that, through a Committee appointed by its Council, it administers £15,300 per annum for meteorological purposes; that the Marine Biological Association has received £5000 as endowment, and will receive £500 a year for five years to aid in maintenance; that the Royal Geographical Society is in receipt of £500 per annum "to enable the Society to provide suitable rooms in which to hold their meetings, and to exhibit to the public, free of charge, their collection of maps." In addition, a number of other London Societies, not receiving money grants, are provided with free rooms in Burlington House, and are thus relieved of a serious outlay for

rent and taxes. There are in Edinburgh a Meteorological Society sustaining an Observatory on Ben Nevis of absolutely unique importance, a Marine Station, which has been engaged in substantial work for three years, and a Geographical Society doing for the public precisely what the Royal Geographical Society does in London ; none of these receives a penny of public money. Besides, there are in Edinburgh Scientific Societies incorporated by Royal Charter, which can point to a history extending over more than a century, and to published *Proceedings* of great value ; and these Societies have not been aided, either by money grants or by free accommodation.

We fully acknowledge that the London Societies are, in a sense, representative of the scientific work of the nation ; but it is a fact that only those investigators who are resident within accessible distance of London have a share in their management. We have confidence in repeating that there are, in London, Societies in receipt of money grants of considerable value, and that there are Societies in Edinburgh equally worthy of support, and much more in need of it, which receive not the slightest Government aid.

NEW BOOKS.

The Peoples of the World ; being a Popular Description of the Characteristics, Condition, and Customs of the Human Family. By ROBERT BROWN, M.A., Ph.D., etc. 6 vols., Illustrated. London : Cassell & Company, Limited.

In his elaborate work on *The Peoples of the World*, Dr. Robert Brown has prepared an appropriate complement and companion to his well-known *Countries of the World* in the same series. He published, some years ago, a book entitled, *The Races of Mankind*, which was very popular. Of that book, the present work is an enlarged, recast, and improved edition. This is honestly avowed by the author ; but, indeed, he was scarcely called upon to do so, for the work has been so completely remodelled, and so greatly extended, that it is practically a new publication.

Dr. Brown is fitted for the production of a work of this kind by a rare combination of qualifications. He is possessed of very extensive and accurate knowledge, derived in large measure from his own travels and observations, and partly also from his command of literature in many languages. It may be truly said, not only of chapters, but also of volumes in the work, that they detail the results of his own experiences. Then the author's scientific knowledge is unimpeachable. He writes of that which he knows ; and therefore the utmost reliance may be placed on his generalisations and his inferences. To this it must be added, that he is master of a luminous and pointed style. It is unusual, indeed, to find scientific accuracy so happily united with literary grace and graphic power. To this conjunction we owe the interesting character of the book, which amounts indeed to fascination. The pages are never dry. They are interesting equally to old and young, to the learned and the unlearned.

The prime object of this work is to set forth in detail, and to illustrate, the differences existing between the different races of men that people the world—their diverse habits and characteristics, and the extent to which their diversities are due to circumstances of climate, situation, occupation, and environment. The work is therefore at once geographical, ethnographical, and social in its bearings ; and it is hard to say in which element it is strongest. The scientific and historical details are interspersed with traditions, legends, and

descriptions of character, which greatly enhance the value of the work as a popular and readable description of the varieties of the human race.

In dealing with dubious and controverted questions, Dr. Brown very wisely takes an impartial line. For example, on the disputed question of the origin of man, he does not commit himself rashly to a particular side. He admits the difficulties that emerge from the hypothesis of the descent of the manifold varieties of the species from a single pair of human beings; but he suggests that the rival theory of a plurality of origins gives rise to perplexities which are at least as great. He therefore confines his function to that of supplying the incontestable data, leaving his readers to draw their own conclusions.

It only remains to be said that the work is profusely and admirably illustrated, and that the illustrations really elucidate the text to an extent that is quite unusual in the present book-making age.

Thorough Guide Series. *Scotland* (Part III.). *The Lowlands, including Edinburgh and Glasgow, and all Scotland south of these Places*, by M. J. B. BADDELEY, B.A., with twenty Maps and Plans by J. Bartholomew, F.R.G.S. London: Dulau and Co., 1886. Pp. 179. Price 4s.

Mr. Baddeley deserves the thanks especially of Scotsmen for showing the tourist so carefully all the beauties of the southern part of their country. He does not confine himself to well-beaten routes, but indicates others deserving of greater attention than they have yet received. Thus he says: "The poets have practically left Kirkcudbrightshire untouched, with the result that nine persons out of ten probably do not know enough of it to pronounce the word properly, and yet there are few counties in our island which display beauty of a more varied character, rich and pleasing for the most part, but displaying in the north-western division depth and wildness which would be remarkable anywhere. No lake of its size can be much levelier than Loch Trool, and no road much wilder than a part of that between Newton-Stewart and New Galloway, though it must be owned that the latter is associated with its full quota of dreariness."

We have examined Mr. Baddeley's guide with the view of discovering any errors or omissions, and are glad to be able to say we found neither. He gives a full and exact account of each place; and when we also look at Mr. Bartholomew's admirable (mostly orographical) maps accompanying each district, we feel that a "thorough" guide is in our hands. As usual, the description of Edinburgh is heralded by an outburst of admiration. It is, says Mr. Baddeley, "without doubt, the finest city in the kingdom. No other, except London, contains so many fine streets, squares, and buildings." To this we cannot possibly have any objection; but the next paragraph perplexes us. "In none," he continues, "except Bath, has Art so successfully adapted itself to the local characteristics of Nature." With every desire to do justice to Bath, we do not consider that, as cities worth seeing, Edinburgh and Bath can be compared: both are built of stone, whereas most cities at home and abroad are built of brick, but there the comparison between them ends.

Mr. Baddeley's guide is worthy to rank as the Baedeker of the Lowlands of Scotland—the highest praise a guide-book can receive.

The Loyal Karens of Burma. By DONALD MACKENZIE SMEATON, M.A.
London: Kegan Paul, 1887.

With all the experience of a Bengal civilian, who has for some years administered part of Burma, Mr. D. M. Smeaton writes, in a style most pleasant to read, of the little nation of Karens, who, in the heart of Burma, have long

been most loyal British subjects, and are fast becoming a Christian people. Hitherto the English reader has known of them, if at all, only from the devoted American Baptist missionaries, who, since Judson's Karen servant first discovered the origin of their traditions in the Bible, have won them over in great numbers to civilisation of a highly progressive type. Now we have a cold official telling how the British Government might have prevented the risings in Upper Burma if it had trusted this people, or believed their missionaries; and discoursing in a cultured style on the ethnography, folk-lore, and political future of this semi-Chinese race, who, in their ancestral homes in the north, must have received the traditions which have prepared them for Christianity from a Nestorian or a Jewish colony in China. Altogether a capital little book!

Bradshaw's A, B, C Dictionary to the United States, Canada, and Mexico.

London: Trübner & Co., 1886. Pp. 304. Price 2s. 6d.

We have here an exceedingly small and convenient guide-book to the most interesting places in North America, accompanied by clear maps of the United States and Canada, and also by one of Mexico, showing the track of the Mexican Central Railway and connections. In his opening remarks, Mr. Bradshaw warmly commends the hotels of North America as "the largest, best conducted, and most comfortable in the world." He wisely adds, however: "Of course, there is little or nothing of the homeliness Europeans are accustomed to find in England or the Continent," for the leading American hotels are "conducted on a large scale, much as a large dry-goods store, or any business where people are more attracted by the quality and price of goods sold than by the proprietor's amiability, friendship, or goodwill." He does not mention in his book, what British visitors will consider of importance, that the mosquito is to be found nearly everywhere throughout the United States, and that the hotels there rarely provide mosquito nets.

We would suggest that, as no Tourist map of Canada can now be regarded as complete which does not give the whole extent, and as many stations as possible, of the Canadian Pacific Railway, the map accompanying this volume (originally constructed for Cook's Tours) should be enlarged, so as to give the whole track of the "C.P.R." from the Atlantic to the Pacific, whilst the guide-book should provide ample information regarding this most interesting route.

A specialty of the work under review is its "Guide to Mexico," hitherto more of an unknown country. The Mexican Central Railway, however, running from El Paso on the United States frontier, and connecting there with various American lines, to Mexico, the capital, will soon open Mexico to the tourist. Indeed, Mr. Bradshaw informs us that "Messrs. Thomas Cook & Son have opened an agency at the capital." So Mexico will doubtless become, ere long, an easy and familiar excursion for tourists.

NEW MAPS.

(*Edited by Professor James Geikie, LL.D., F.R.S.*)

EUROPE.

CENTRAL-EUROPA, Neue Uebersichtskarte von —, im Massstabe von 1:750,000 (11 $\frac{3}{4}$ miles to an inch).

Herausgegeben vom K. K. Militär-Geograph. Institut in Wien.

The publication of a Map of Central Europe, which is a minute and careful

reduction of the surveys of the different countries, engraved in a clear and legible style to show effectively all the physical and topographical features, is at the present time a work of great public use and importance.

This Map, which has just been completed by the Imperial Military Geographical Institute of Vienna, is the result of more than four years' constant labour of their large staff. It consists of forty-five sheets, each measuring 12 inches by 15 inches, and embracing the whole of Central Europe, extending from the Baltic Sea to as far south as Rome, and from Kieff and the Bosphorus in the east to Lille and Avignon in the west, although unfortunately not extending far enough west to include Paris and London, which would have greatly added to its usefulness. The work is produced by the heliographic process, and printed from the stone in different colours. The rivers, lakes, and all waters with their names are printed in blue; the towns, railways, etc., and their names in black; the roads in red; and the orographical relief in brown. This method, although it has the advantage of giving more distinction to the various features, lacks the exact precision of an outline which is all engraved on one plate, as the slightest deviation from perfect register in printing may in some cases throw a road on to the other side of a river. One very useful feature in connection with the Map is that the Institute annually publishes tracings of all additions and corrections, such as new railways, canals, etc., and these have only to be laid over the place requiring correction. These tracings are presented gratis to all possessors of the Map, so that all the copies may be kept up to date. The original sheets are, however, always corrected to date of publication.

DEUTSCHEN REICHES,—EDUARD GAEBLER's Taschen-Atlas des —, und der Deutschen Kolonial-Besitzungen, mit begleitendem Text.

Leipzig: Karl Fr. Pfau. M. 2.50.

As a travelling companion in Germany this little Atlas ought to prove very useful. It consists of a map of the country on the scale of 1 : 1,750,000, divided into fifteen sections, with larger-scaled inset maps of the principal towns. The maps are clear and effective, with the railways printed in red, and contain all places of any importance. There are also three maps illustrating the colonial possessions, and the whole is accompanied with geographical statistical notes.

OESTERREICH,—Sprachen-karte der westlichen Kronländer von —. Nach dem Zensus von 1880, entworfen von F. HELD. Massstab, 1 : 1,500,000.

Petermann's Mitteilungen, Jahrgang 1887, Tafel 2. Gotha: Justus Perthes.

AFRICA.

CONGO,—Route von Ango-Ango nach Leopoldville. Aufgenommen von OSCAR BAUMANN, Mitgleid der von Professor Dr. Oscar Lenz geleiteten Oesterreichischen Kongo-Expedition. Massstab, 1 : 400,000.

Wien: Mitteilungen der K. K. Geographischen Gesellschaft, Band xxix., No. 10.

This map, on the scale of about 6½ miles to an inch, shows what great advances are being made in the opening up of the Congo. Here we have even a plan of Leopoldville, which was founded on the shores of Stanley Pool in 1881. The map seems to incorporate all our present topographical knowledge of this district, which is specially interesting, as it is the cataract part of the river, along which it is proposed to construct the railway.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE CONGO: ITS PAST AND PRESENT.

BY COLONEL SIR FRANCIS DE WINTON.

(Read before the Society, January 1887.)

In a paper published by the Scottish Geographical Society, in January 1885, a *résumé* of the labours of sons of Scotland in the work of scientific explorations is given. Foremost on this roll of explorers, missionaries, and commercial adventurers stands the honoured and revered name of David Livingstone. To his unceasing efforts, to his untiring industry, to his noble devotion, have the secrets of that unknown land—Central Africa—been unlocked and disclosed. I am not here to-night to dwell on the work he performed, for is it not world-known? He attempted the conquest of Central Africa alone, and he gained a great victory; and the spectacle of that solitary man wandering in those tropical regions, with few attendants, with no weapons save his own gentleness, his marvellous patience, and his earnestness, is to me (and I have recently had some experience of African travelling) a spectacle of the sublimest heroism and devotion to duty. Not the least of the legacies he has bequeathed to the world—legacies in richness of geographical knowledge probably unsurpassed—is that he has taught all future African explorers the true art, the right way, of travelling in Africa. In fact he has taught how exploration can be carried on successfully. Among those who have sought to follow in his footsteps, who have endeavoured to increase our knowledge of Central Africa, Mr. H. M. Stanley stands foremost as the ablest successor of Dr. Livingstone. Now, what Central Africa and the sources of the Nile were to Dr. Livingstone, the Congo and its basin have been to Mr. Stanley.

And my purpose this evening is briefly to discuss the river Congo, its basin, its development, the recent discoveries that have been made among its tributaries, and its present position. To do this I have to crave your

kind indulgence. I am not an explorer in the proper sense of the word, and I cannot lay claim to the possession of any scientific knowledge. When the late General Gordon was called upon by the Government of his country to proceed to Egypt, I was selected by His Majesty the King of the Belgians to go to the Congo to relieve Mr. Stanley. Conceiving it to be a call of duty, I accepted the position, and went to the Congo, remaining there about two years. Naturally, I had to travel a great deal, and in those excursions I went as far as $21^{\circ} 20'$ E. long.—about 1000 miles into the interior—but my duties were chiefly administrative. To my predecessor had fallen the hard work. His latest book, *The Congo Free State*, tells us of the many stations he established, the miles of territory acquired, the immense distances he traversed. My duties were to bring the results of his labour under administrative control, and weld them into a useful mass. The events which led to the creation of the “Congo Free State” are so very recent and so very fresh in your minds, that I only propose to allude to them most briefly. After Mr. Stanley’s discovery and descent of the Congo, the attention of Europe naturally turned to the magnificent opening which this second longest river in the world presented to the influences and enterprises of civilisation ; and it was resolved by a committee of gentlemen assembled at Brussels, under the auspices of His Majesty the King of the Belgians, to subscribe a sum of money for the purpose of exploring, more fully than Mr. Stanley was able to do in his rapid descent after three years of fatiguing travel, the waters of the Congo, and to ascertain to what extent they were navigable—in fact, to extend our knowledge. And in January 1879 the arrangements were so far completed that Mr. Stanley had organised an expedition, and was on his way to Zanzibar to recruit men. On the 14th of August, the same year, he arrived off Banana Point to begin the work which has ended in the Congo Free State ; and, to use his own eloquent words, “To ascend it with the novel mission of sowing along its banks civilised settlements, to peaceably conquer and subdue it, to remould it, in harmony with modern ideas, into national states within whose limits the European merchant shall go hand in hand with the dark African trader, and justice, law, order shall prevail, and murder and lawlessness, and the cruel barter of slaves, shall for ever cease.”

From this point of the narrative the real difficulties of the work of founding the State commenced. On the 26th September 1879, Mr. Stanley and his flotilla reached the head of the navigation of the lower river. Here the hilly land, which commences some 30 miles lower down at Boma, becomes bolder and more defined ; the river is nearly a mile in width, and has lost its smooth gliding motion ; the current is stronger ; watching it closely, one observes, at almost regularly recurring intervals, huge volumes of water heaved up, as if by some hidden agency, from beneath, which, surging onwards and impelled by the current from behind, form themselves into whirlpools ; backwards and forwards eddy and current strive and race one with the other ; while here and there broad

stretches of water glide with that peculiar swiftness betokening rapid descent, only to break with curling waves as they encounter the treacherous rocks beneath. From this mass of seething, hurtling water issues a peculiar moaning sound, the voice of the spirit of the river hurrying on to the sea. Thus the cataract region of the river presents a sublime spectacle almost impossible to convey by word-painting. I have seen Niagara and all its rapids; I have descended the St. Lawrence, and been on many other inland waters; but none can compare in the power they reveal, in the awe they inspire, in the majesty they display, with the rapids of the river Congo.

In four months the station of Vivi was completed, then followed the establishment of the station of Isangilla, the building of a road some 50 miles long, and the transport of three steamers across it. From Isangilla the expedition continues to push forward. One small steamer is again launched on the Congo, as, for about 70 miles between Isangilla and Manyanga, the river becomes navigable, though it is a navigation that requires both prudence and care, for there are several dangerous rapids to be passed. I remember once coming down this portion of the river in one of our whale-boats (a large boat which pulled twelve oars, six on a side). We had passed most of the rapids, and were gliding along what appeared to be a quiet reach, when suddenly, with a hissing noise, the water began to boil all around the boat. "Pull!" shouted the steersman, and pull the men did, but it was in vain, for we were caught in a whirlpool, and the only plan was to accept the situation. The men laid on their oars, and the boat went slowly round four or five times till the water had exhausted itself, and allowed us to continue on our way. Through all the year 1880 the expedition was fighting its onward way, not so much against the inhabitants as against the forces of nature, and it was not until April 29, 1881, that Mr. Stanley found himself established at Manyanga, with still 95 miles to accomplish before reaching Stanley Pool, where the waters of the Congo once more become navigable, and from whence the interior of Central Africa can be conquered—conquered by the merchant and trader, and consequently for the missionary and man of science. Well, not to weary your patience with this section of my paper, I will take you to December 1881, when Stanley, with three small steamers, half-a-dozen white men, and 150 Zanzibaris, found himself established at Stanley Pool, not without many difficulties, and not without considerable opposition from the natives. The former were successfully overcome by his indomitable energy, and the latter was peacefully accomplished by his tact and profound knowledge of native character. For the interesting details of this portion of his work, and that which followed, I would recommend the perusal of *The Founding of the Congo Free State* to those who have not already read it.

One would naturally suppose that such an amount of labour would content the ambition of any ordinary man, but Stanley's active mind and enterprising spirit could not rest satisfied—he was bound to push on.

So, after four months' rest at Leopoldville, during which the little steamers were launched at Stanley Pool, and their gear was fitted, preparations were made for a lengthened voyage over the waters of the Upper Congo. During the years 1882 and 1883 these explorations were continued; Lukolela, Equator, Bangala, and Stanley Falls were reached, and stations were established; and at the end of 1884 he returned to Leopoldville, broken in health by the constant anxiety and fatigues he had undergone.

Unhappily, all had not gone well in his absence. I may mention that when I succeeded to the command, the eighty white *employés* of the Congo Free State were composed of Belgians, French, Germans, Austrians, Slavs, English, Americans, Swedes, Norwegians, Danish, Italians, and Portuguese—twelve nationalities in all. These, in place of seeking on what points they could agree, sought only those points on which they could differ: and thus the expedition, instead of striving towards the success which, by the magnificent liberality of His Majesty the King of the Belgians, was within their grasp, and not having the guiding influence, the foreseeing prudence, and active energy of their leader, were fast drifting into chaos and confusion. Ill as he was, worn both in mind and body, and weak and suffering, his presence infused a new spirit, and when I arrived in 1884 a marked change for the better had already taken place. Five weeks after my arrival Mr. Stanley departed for Europe to obtain that change and rest he so greatly needed.

Before he left, however, difficulties had arisen with the Portuguese and the French, who both viewed the operations of the expedition with distrust and disfavour, the latter because they interfered with the designs of the French explorer De Brazza, and the former because they considered it interfered with what they claimed as old rights of the Portuguese nation to that portion of Africa. These differences, as you know, were finally settled by the Berlin Conference. Such is a brief retrospect of the history of the Congo Free State, and you will, I am sure, agree with me that it would be impossible to separate the name of Mr. H. M. Stanley from so interesting a record. The history of the previous state of the Congo presents so dark a page that it would only lead to painful thoughts were I to introduce it to your notice this evening. Happily, now all is changed. The huge barrancas or buildings formerly used for the storage of slaves now contain peaceful trading goods. The population of the interior is increasing, and the black cloud of slavery no more overshadows the land.

During the period of my administration (from 1884 to 1886), the exploration of the tributaries of the Congo, many of them mighty rivers in themselves, was carried on with vigour and success. I propose to divide them into three groups or expeditions; that conducted by Lieut. Wissmann of the German army, which discovered the course of the Kassai, and its tributaries the Sankuru, the Luebo, the Loango, etc. Then the discoveries of the Rev. Mr. Grenfell, of the Baptist Mission, who explored

many of the numerous tributaries of the Congo in his little steamer the *Peace*; and lastly the journeys of Lieut. Kuntz and Dr. Buchner. In 1883 an expedition arrived at Benguela on the West Coast, under the command of Lieut. Wissmann, who was accompanied by Dr. Wolff, Lieutenants Müller and von Francois, and Messrs. Schneider and Buchner. These five Germans, with a large caravan, marched to the east in two columns through a very difficult country. The real point of the expedition had been kept a profound secret. It was to penetrate into what is now known as the Baluba country, through which pass the upper waters of the Kassai, the Lulua, and other rivers, there to erect stations, then to descend the waters of the Kassai, and ascertain geographically the true position, course, and extent of that noble river.

This part of Africa is situated in 22° E. long. and 6° S. lat. The expedition had really been fitted out by His Majesty the King of the Belgians, and was intended to occupy territory for the then International Association. It was not the first time Lieut. Wissmann had been in Africa; he accompanied the late lamented traveller Dr. Pogge, and he therefore had an acquaintance with these Baluba people, and was eminently qualified for the mission. Well, this expedition arrived, after a toilsome and painful march, at the first stopping-place of its journey. The establishment of a station was commenced, houses were erected, and the building of a small fleet of canoes was rapidly pushed forward. Such was the influence Lieutenant Wissmann obtained over these people that their chief, Kalembe, and his legal successor Chigenga, with about 200 of their followers, agreed to accompany him, and in April 1885, leaving their newly-formed station in charge of Dr. Buchner, they embarked in twenty large canoes on the waters of the Lulua.

At first navigation was difficult; rapids impeded progress, canoes were upset, and two natives of the party lost their lives. On the sixth day of their travels the junction of the Lulua and Luebo was reached. This junction forms the north-west end of the Baluba kingdom, the Lulua being the dividing line between the Baluba and Bacuba; the Luebo separating the Baluba from the Bachilele. Since then a station has been formed at this point, which is under the control and auspices of the Congo Free State.

Continuing their descent, the navigation became easier; no more rapids were encountered, and soon the Lulua joins the Kassai. Following on, they arrive at the junction of the Sankuru and the Kassai, whose united waters form a noble river with a W.N.W. course; and the gallant band of explorers floating on its waters advance each day nearer to the goal of their hopes—the Congo.

They were not without adventures. At one place a tribe called Basongo Menos treacherously attacked them while they were entangled in one of the many narrow channels of that part of the river. At another place they killed seven elephants in as many minutes. At length, on the forty-second day, they sighted the waters of the Congo,

which at first they took to be a large lake. Soon, however, a turn in the river reveals a flag floating in the gentle breeze, and in a few minutes more the buildings of the station of Kwamouth come in sight, and then they know that the object of their journey has been gained, that the battle has been won. Three days after they descended the Congo, and arrived at the station of Leopoldville in Stanley Pool. Thus their journey had been crowned with complete success; they had discovered the Kassai River, one of the noblest tributaries of the Congo; they had traversed more than 800 miles by land, and had passed down over 500 miles of hitherto unknown and unexplored territory, besides making other explorations in the neighbourhood of Baluba. Shortly before this I had left the Lower Congo to visit Leopoldville, with the hope of hearing something of Lieutenant Wissmann, for the plan of his journey had been communicated to me from Brussels, so that my hopes were quickly realised. Then came the question of taking these people back to their country, and by so doing creating a feeling of trust and confidence in their minds, leading to their becoming useful members of the new State. It would never have done to send them back by land, involving long and painful marches, with the possibilities of hostile interruptions on the road. The canoes which had conveyed them down a river would never go up one; so I determined to use *The Stanley*, a new stern-wheel steamer of about 30 tons, recently launched on Stanley Pool. These Balubas were a very interesting people, differing in many respects from the Congo native. They had about fifteen years previously to Lieutenant Wissmann's advent passed through what might be called a religious and social revolution. The old faith—which consisted of a good deal of fetish and still more malafu (palm-juice wine)—was overturned; all the palm-trees in the country were cut down, which, from a picturesque point of view, was a pity. Drunkenness was made a capital crime, as was also theft; and the sole punishment of the country was the smoking of hemp, the culprits under the sentence of death being compelled to smoke it until they dropped. The sister of the king, a middle-aged, wiry-looking female (she was about forty when I saw her), named Sankoro, became high priestess and exercised great power. Fetishism disappeared, and all seemed contented and happy.

Most of the African tribes have some distinctive mark tattooed on divers parts of their bodies, but the Balubas were covered with marks, many of them very artistically done. I could not make out that they had any traditions, but they were a marked contrast to the Congo native, and were the least troublesome natives I ever met. We were, all told, 238 people on board this small steamer, and they had to be packed on deck like sardines in a box; but they were always cheerful, and in about three days had all settled in their places, which they kept during the voyage. At night they all disembarked and made camp, their favourite camping-ground being a sandy island—the sand formed a warm bed. This return voyage took about thirty days, and I then went back to the

Congo, having established the station before alluded to at the junction of the Lulua and Luebo. I am under a promise to Kalemba and Sankoro to pay them a visit ; and the good things I was to have—amongst others, a wife—as set forth in a speech by Kalemba, was a proof that they possessed that somewhat rare quality of an African native—gratitude. But I fear my African travels are over, and that I have bidden adieu to the kind and gentle faces of my Baluba friends. Nevertheless, if any of my audience would like to pay the Balubas a visit, I will give them such letters of introduction as will ensure them a hearty reception.

To enable Dr. Wolff to continue the exploration of that region, I left him a small steamer (the *En Avant*), and in a very interesting letter received from him a short time ago he writes as follows about this region :—"The Kassai, the Sankuru, and the Lomami form a navigable river system of over 1000 miles. The Sankuru is a magnificent river, sometimes 2000 to 3000 yards in width, average depth 12 to 14 feet, and easier to navigate than the Kassai." He followed the Sankuru and Lomami till he reached within 200 miles of Nyangwe, and crossed two roads established by the slave and ivory traders, who have already penetrated into that portion of Africa, and established their hideous traffic. Quantities of ivory and india-rubber were seen ; and, although the natives did not understand the value of the latter, the fact that it exists in such large quantities is important from a commercial point of view. A large and numerous population was met with, especially on the left bank, and numerous canoes were seen. Dr. Wolff says :—"I was often accompanied by fifty canoes, each holding eighty people." As canoes in Africa are hollowed out of single trees, this is an evidence of the forest growth of that region.

But I must not dwell too long on this portion of the Congo basin. So let us turn to the second group, or the discoveries of Mr. Grenfell. These are very important, as you will observe from the following *résumé* of the work he has done. We will ascend the left or southern bank of the Congo, for the actual dates of his discoveries are not, after all, of so much importance to us assembled here to-night as to the future historian of the Congo. We have followed the Kassai, which joins the Congo at Kwamouth ; then, close to Equatorville, another large river enters the Congo. If I do not to-night mention many names, it is because the names of all Central African streams are not sufficiently well known to give one a clear understanding as to their actual locality ; and also because names, especially names of rivers, vary so much in those latitudes. For example, a river may have a dozen different names as you proceed along its course ; one village will call it by a word meaning that its waters "come from afar," another will name it from the "colour," another from the "size," another from the "slowness" or "swiftness" of its current ; and you also know there are the eccentricities of explorers, who will persist in making alterations in names

very puzzling to the student of geography. So that, with one or two exceptions, I will simply point out the locality of those rivers, and we will leave the names to be settled at some future date. Well, to return to the river near the station of Equator, it has two branches, the southern one Mr. Grenfell ascended as far as 20° E. long., and the northern one to about $23^{\circ} 20'$ E. long. You will note the long distance travelled.

About halfway between Equator and Bangala he explored another tributary, ascending it a little beyond 22° E. long., or about 240 miles. Round the bend of the horse-shoe of the Congo, the country, on its left or south side, is low and marshy, and it is not till you arrive at 24° E. long. that any river of magnitude again appears. There we find a river running into the Congo from due south. It bears various names, but that which is the most common is Lomami. Mr. Grenfell ascended it for at least 200 miles, and found it a winding stream easy of navigation, with a large population. You will observe that this river must from its position have its origin not far from the Sankuru of Dr. Wolff, one of whose tributaries (which Dr. Wolff also ascended) was likewise called the Lomami. It is therefore probable that the tribes inhabiting these two rivers trade each with the other, and that the two rivers having similar characteristics have received the same name. Now let us cross over to the right or northern bank. Here Mr. Grenfell ascended the Loika for about 120 miles, as far as $23^{\circ} 20'$ E. long., till he was stopped by rapids. This river, as you will see in the concluding portion of my paper, may be destined to play an important part in the expedition for the relief of Emin Pasha. A little further on is the Biyéré or Aruwimi.

Following down stream, no tributary of any magnitude is passed till we come to the Mobangi or Ubangi, which Mr. Grenfell ascended as far as 4° N. lat. It is a grand river this Mobangi, and the problem as to which is the greater, the Kassai or the Mobangi, has yet to be solved. But there is a still more interesting problem to be solved as regards this river. Where does the huge body of water come from? Does it come from the north, or does it spring from the mountain ranges of the Niam-Niam and Monbutto country? Is it, in fact, the Welle of Schweinfurth? The general direction of the Mobangi, as ascended by Mr. Grenfell, was north-east, but at the point where he turned it was trending decidedly to the eastward. Now in the same latitude—viz., 4° N.—Dr. Junker descended the Makua-Welle as far as 22° E., leaving only two degrees, or say 120 miles, between his descent and Mr. Grenfell's ascent. The inference is obvious, and I think there can be no doubt that the Mobangi will prove to be the Welle of Schweinfurth, and possibly within a couple of years this important geographical question will be settled. Before quitting the discoveries of Mr. Grenfell you will, I am sure, agree with me that, as one of the explorers of the tributaries of the Congo, he has achieved discoveries of the greatest importance and value. It is true he had not to contend with the discomforts and inconveniences which attend

the traveller by land; but that he should have navigated so many hundred miles of inland waters reflects the highest credit on his skill and on his fearlessness. For the *Peace* is only a small steamboat, and the anxieties of an explorer by water are quite as great as those of an explorer by land. Naturally, to the native mind a steamer is a very strange object. They cannot understand how such a canoe can ascend, without paddles or other outward means of locomotion, the steady currents of these rivers. I remember one wise old man, after a careful survey of the *Stanley*, gravely informed a large and admiring dusky audience that the white man's canoes were pushed along by a *mundella* devil, i.e. a white devil, who was very strong, and who was kept in the boilers and fed with fire and flame—the only food which could enable him to make the wheel go round.

The third group—that is, the discoveries of Lieutenant Kuntz and Dr. Buchner—consist principally of land journeys on the Kwa and across the Kassai as far as the Lukenye. Dr. Buchner, striking the Kwa near Matundo, completed the portion of that river hitherto unexplored, by following it down to its junction with the Kassai. Lieutenant Kuntz crossed the Kwa and Kassai, reached the Lukenye, and completed important discoveries of the portion of country between the Kassai and Lake Leopold, discovered by Mr. Stanley in 1883.

You have now a brief *résumé* of the discoveries that were attempted and successfully carried out between the years 1884 and 1886—discoveries which in the brief space of two years have seldom been equalled in the distances traversed, the new territory explored, and in the geographical knowledge given to the world. Let me for a few minutes reply to the question, What is the real value of these discoveries? If you look at the map you will see that the Haut Congo (that is, the Congo above Stanley Pool) forms a vast horse-shoe, extending from 17° E. long. to 24° E. long., all of which is navigable water, while its tributaries range from 4° 30' N. lat. to 8° S. lat. This vast area is a rectangular table-land of nearly 500,000 square miles in extent. It is but a few hundreds of feet in height, having a gradual slope from the south-east to the north-west. Now this huge tract is intersected by an almost unique system of natural canals. There is scarcely a hundred miles of its area that is not approachable by a waterway. Nature furnishes this tract with ample supplies of water, and it only needs the perseverance and hand of man to connect it with the ocean, and develop the resources of this immense territory.

What possibilities lie hidden in the future of such a country!—what opportunities can be opened for commerce and civilisation! But you will say—How about the natives; what are they like? And this vast territory—what is the value of it?—what are its products? These are very pertinent questions, and questions to which all thinking minds demand a reply.

As regards the native population, and the influence they may exert on the future of the country, it may be stated as a general principle that

whatever natural advantages a country possesses, the rest of the world cannot enjoy them if the inhabitants of that country are a strong, united, warlike race who object to intercourse with the outside world. Now, the inhabitants of the Congo are not a warlike race. The short history I have given you of recent explorations over many hundreds of miles without any great dangers offers strong proofs of this fact; and my own experience—and I had to govern from two to four millions of them—was to the same effect.

Then, too, there is the tribal formation of the country, which is another reason—a strong one—why no serious resistance can be offered by the natives to the dual forces of civilisation and commerce. In the Congo Free State there are no powerful chiefs like Mwanga of Uganda. The population of the country is split up into small communities, in many cases not exceeding four to five villages. Therefore, in a country where every one is weak, where there is but little unity, where no strong hand exists by which nations are made or communities become powerful, where autonomy is the law of the land, you can well understand that a settled form of government on European principles, administered with wisdom and justice, respecting the manners and customs of the natives, and dealing with them judiciously, ought not to meet with any great difficulties from a population, however large, living under the conditions which I have endeavoured to describe.

There is another trait of the native character to which I should like to invite your attention. He is a born trader. He loves commerce for commerce' sake, he is a keen hand at a bargain, and his greatest pleasure—I might almost say his sole occupation—is attending the market-places. These markets are an established institution of the whole country. They are generally chosen in some central spot where trees offer a little shade, and are held about every four days. Many native traders go from one to the other, as they are often not more than a day's march from each other; and it is an animated sight to see a large market in full activity. Dusky ladies, got up in their best handkerchiefs and their smartest beads, often find a husband on such occasions. Chiefs strut about clad in their choicest clothes. Quarrels are discussed, and challenges are issued at these meetings; and after a war between the two villages the market-place is the conference chamber where the articles of a peaceful treaty are negotiated. Yes; if you want to study the native character, I know of no better place. I remember the last time I passed by the large market of Marza Nkenga, sitting on a box watching the scene. I saw a dark belle who evidently had a good opinion of herself, look a rival belle from another village up and down, and the expression of her face said, as plainly as if she had uttered the words, "Ah, your handkerchief is not so good as mine! Oh, what horrid beads you have got! Mine are far better"—and I could not help smiling as the thought passed through my mind, "The world is the world all the world over!"

I think there are two very important points with reference to the

Congo,—this tribal formation and absence of any strong native ruler, and this innate love for trade, for the one guarantees security, and the other invites commerce.

I now approach with some fear and diffidence to the subject of the probable commerce of this country. There have been a good many opinions given, and statements made, in favour of Central Africa as a country for trading purposes, while there have been almost an equal number to the contrary. I remember once when at Gibraltar, one of the most distinguished generals of the United States Army—General Sherman—was visiting Europe, and dined with the Governor, the late General Sir Fenwick Williams, on whose staff I was at that time serving. One of the American officers who accompanied General Sherman during dinner told my brother aide-de-camp a series of remarkable stories of his personal experiences during the war. Courtesy towards the guest of his chief prevented my friend from showing what he really felt; but at last a very "tall" story about some enormous herd of buffaloes caused him to make a qualifying remark expressing doubt, when the American officer looked at him for about a second, and then said: "I guess I'll take that back!" Now, I cannot help thinking that some of those who have spoken most strongly against Africa as a commercial country might, if they visited the Congo, like to take some of their opinions back. We all know that the trade and commerce of the world are not guided or fixed by any special rules or system. The mainsprings of commercial enterprise are energy and perseverance, and if these qualities are introduced into Central Africa there is no reason why they should not succeed in that part of the world, as they have done in many other parts of the globe whose earlier prospects were not more inviting than those of the territory we are discussing this evening. There are vast stores of ivory untouched—ivory that has been collected for hundreds of years. But you say, this ivory is limited. True, yet it is a valuable article in the world's market—valuable enough to pay the first expenses; and having this product as a base on which to work, you have rubber, various kinds of gum, oils, orchella, and many other tropical productions, all of which will be forthcoming as you teach the natives their value. Take rubber, for example; we all know that new uses are continually being found for the employment of this valuable elastic gum. Now the forests of Central Africa abound with several varieties of trees belonging to the species which produce this gum, and when once the natives are taught how to collect and prepare it, the supply is almost inexhaustible.

But you do want one thing, and that is a railway to connect the navigable waters of the Lower Congo and the ocean with the waters of the Haut Congo with its many hundred miles of navigable tributaries. There is at the present moment a syndicate formed in Belgium for the construction of such a railway. Let us hope that their efforts may prove successful; and if they are successful, there exists in my mind no doubt of the future of this portion of Central Africa.

For such a railway will not only introduce commerce, but it will facilitate the establishment of large commercial undertakings like the National African trading company on the Niger—like the enterprise in Borneo—like the old East India Company and Hudson's Bay Company, who governed as well as traded, and exercised a wide and judicious control over extensive areas of country. Under their auspices the missionary could safely carry on his peaceful calling, and the man of science pursue his useful and delightful occupation in security and tranquillity. And there is yet a brighter aspect to this glimpse of the future,—I crave your indulgence, for I must recollect that my paper deals with the Congo, Past and Present—the burden and curse of slavery will become a thing of the past; and in this wise, as the commercial adventurer draws the ivory from the country by the legitimate operation of trade, the Arab ivory trader and slave dealer can no longer carry on his double traffic. In justice to the Arabs it should be stated that they do not, as a general rule, treat their personal slaves with cruelty; but it is in the collection of ivory and in its transport to the sea that wide tracts of country are ruined and devastated, and the inhabitants are taken and forced to carry the ivory, of which they have been robbed, to the markets of the coast—it is in this traffic that revolting cruelty is practised, and human life sacrificed. Take, for an example, the position of Emin Pasha. He rules a large area right in the heart of Africa; he cuts off the Arab slave-dealers of Tanganyika and Nyangwe from the Bahr-Gazelle; he has held his own for four years, and to the honour of a few gentlemen—at the head of whom stands one of the most honourable men in all Scotland, Mr. W. Mackinnon—an expedition has been organised and started to send relief and supplies to this brave man; and I may congratulate your Society on being one of the contributors to this noble enterprise.

As you all know, the most capable—the one man—to whom the command of such an expedition can, humanly speaking, with confidence be intrusted—I mean Mr. H. M. Stanley—has volunteered to lead the expedition. Giving up an extremely lucrative lecturing career in the United States and Australia, he, without hesitation, placed his services at the disposal of Mr. Mackinnon and a committee of gentlemen, asking no reward or remuneration, being content to place his unrivalled knowledge of Africa, his boundless energy, his fertility of resource, his life, at the call of duty and in the cause of humanity. It has been my good fortune, springing out of the friendship that exists between Mr. Stanley and myself, and in consequence of the experience I gained during two years' residence on the Congo, to assist him during the past three weeks in preparing for his coming work; and it will, I am sure, be interesting to you all to hear a brief statement of the events that led up to this enterprise, and of the general plan and proposed route of the expedition.

On the 13th December last, Mr. Stanley, then at Amherst in Massachusetts, received a telegram from Mr. Mackinnon informing him that a

grant had been obtained from the Egyptian Government, that he was prepared to guarantee the rest of the money required, and asking if Stanley would take charge of an expedition to relieve Emin Pasha. His reply was prompt, and on the 15th December he embarked from New York, landing in England on the 23d. Time being a most important element, since then not a moment has been lost.

Lists were made out of all the requirements of the expedition, which consisted of cloths, trade goods, tents, camp equipment, European provisions, arms and ammunition—of the latter a large extra supply is taken for Emin Bey—pack-saddles for donkeys, a boat in sections to facilitate transport; medicines, instruments, and a variety of smaller articles absolutely necessary to an expedition the duration of whose absence might be eighteen months, and whose object was to penetrate into the very heart of Africa, and whose numbers were eight whites and about five hundred blacks. Telegrams were also despatched to Zanzibar to recruit a body of five hundred picked men, for it has been found that the Zanzibaris are the best class from which a traveller can select his caravan. Mr. Stanley has on many previous occasions tested their fidelity and endurance. Directly it was known that an expedition was about to start, applications to serve came pouring in. One similarity ran through at least two-thirds of these applications, and there were over four hundred—that the writer possessed in a remarkable degree all the necessary qualifications which a leader of such an expedition as Mr. Stanley was about to undertake would desire his subordinates should possess. The days passed rapidly, for Mr. Stanley had decided he and his expedition must reach Zanzibar by the mail, due at that place on the 21st February; this date being fixed, it was absolutely necessary the expedition and stores should leave England not later than the 20th of January.

As soon as possible after the return of Mr. Stanley—that is, on the 29th of December—a committee of gentlemen met, to whom the general direction of affairs was intrusted, and by them it was unanimously decided that, as Mr. Stanley had accepted the command, the choice of route should be left entirely to his own judgment and discretion.

In the middle of all these preparations Mr. Stanley received a summons to go to Brussels to see His Majesty the King of the Belgians. The interview was an important one, and has since exercised a happy influence over the fortunes of the expedition. At the interview His Majesty offered to place all the available transport on the Haut Congo at the disposal of the expedition, and to give it all facilities in the power of the State, in order that the expedition might proceed *viâ* the Congo to the relief of Emin Pasha.

Such a munificent and gracious offer could not be overlooked. Fresh calculations had to be made. The question of transport of the expedition from Zanzibar to Banana *viâ* the Cape was a serious financial consideration, as well as the question—Would the steamers, etc., now on the Upper Congo be sufficient for the necessities of the expedition? Mr.

Stanley, without any hesitation, said he was prepared to adopt either route, though he considered the Congo route preferable for the following reasons :—

1. That it is, if anything, shorter than the Eastern routes, of which there are four.
2. That it is less dangerous.
3. That it would afford a safer route for the return of the women and children whom Emin Pasha is desirous to send out of the country.
4. It would create in all probability a permanent route by which Emin Pasha or his successor could receive supplies.
5. It would avoid a danger to the English and French missionaries at present in the power of Mwanga, the King of Uganda, who, on hearing of the approach of a large caravan near his territory, might cause them to share the fate of the late Bishop Hannington.

On the 12th of January the change of route was adopted, and His Majesty's offer was accepted. Some further negotiations were entered into concerning the steamer for conveyance of the expedition *viâ* the Cape, but these were finally and satisfactorily arranged by Mr. Mackinnon on the 20th of January; last Thursday the main body of the expedition left England in the *Navarino*. Mr. Stanley left on the night of the 21st *viâ* Brindisi, hoping to have a few days at Cairo, where he will have the opportunity of meeting Dr. Junker; and a small section of the expedition leaves on the 28th, proceeding direct to the Congo. With the exception of the latter, all the rest are due at Zanzibar on the 21st February. They will probably leave on the 23d, arrive off Banana about 12th-15th March, and be at Stanley Pool about 10th April. From this point it will take from forty to fifty days to ascend the 900 miles of the Congo, and from the highest navigable point to which they ascend it is not more than thirty-five days' march to the shore of Lake Albert Nyanza. Let us wish them God speed, and may He in His infinite mercy uphold them with the right hand of His righteousness, and bring them back to us in safety and with honour.

We have thus, this evening, traced the recent history of the Congo down to this last expedition which is shortly to be launched upon its waters. We have touched upon the rise of the Congo Free State—we have followed the track of the explorers during the past four years—we have seen what a rapid development has taken place in the Congo basin, and we have considered what possibilities this mighty river may exercise on the commerce of the future. But behind and above all these considerations there arises the deep and solemn thought that the struggle between Christianity and Mohammedanism has yet to be fought out. There is no doubt that Mohammedanism, in its more direct appeal to the senses, and in all its general aspects, is a religion more easy of adoption by the natives of Central Africa. What little they are required to understand provides them with an excellent substitute for fetishism.

It does not interfere with their established manners and customs, it requires no surrender in their easy barbaric life.

But with Christianity it is far different. They are called upon to give up self, and the example and history of Our Lord's Sacrifice is incomprehensible to their minds.

But now a pathway has been laid open. This mighty Congo, with its numerous tributaries, and its hundreds of thousands of inhabitants, lies at the feet of the civilised world. From the North and from the East the tide of approaching Mohammedan invasion can be hurled back from its shores, and then, in the fulness of time, the light and glory of Christianity will shine upon and illumine the land.

ON REALISTIC AND DRAMATIC METHODS IN TEACHING GEOGRAPHY.¹

BY WILLIAM JOLLY, H.M. INSPECTOR OF SCHOOLS.

FEW subjects are less skilfully taught in our schools than Geography; nay, as a whole, along with History, it would not be far wrong to say that it is the worst taught of common subjects. It is generally traversed with the greatest care and even hard work, but it is made, as a whole, a painful process of mere memory grind, with the minimum of intelligence. As remarked by Fitch, it is often most ostentatiously offered to the examiner when the teaching is weakest in intellectual training, and it is a favourite subject with mechanical teachers.

It is generally deemed easy to teach, like its abused companion, History. In reality, it is not easy—nay, it is difficult to do really well, the elements of misconception by the pupils are so numerous and so great, and the temptations to the misuse of memory are so strong. Rightly taught, there is no more valuable, informing, or fascinating study; nor any one more pleasantly and highly intellectual.

As a trainer of the reasoning powers, it may be made of the greatest service. In this aspect, Fitch has over-pressed its character of belonging to mere fact-lore. In a sense, on such a theme, the facts are primary, as urged by Fitch, and the mental training secondary; but the two should never be disassociated. Skilfully treated, intelligence can always be brought to bear more or less on the facts, either in themselves, their causes, their results, and their relations, or in the manner in which they are educationally reached in the course of learning.

Reform in the teaching of Geography is urgently needed, in text-books, apparatus and method. It should be released from the bondage of the over-burdened statistical school-book, and redeemed from the fact-lore to the rational field. Grind should be minimised, memory subordinated,

¹ Delivered in the Industrial Museum, Edinburgh, on 9th July, 1886, under the auspices of the Society.

and the whole teaching interfused with renovating interest and intelligence. And there are recently most encouraging signs of reform, more perhaps than in most scholastic subjects. It is well and wise that the Scottish Geographical Society should have taken up so vigorously its teaching, for there lurks the seat of the disease they wish to cure.

It is the special aim of this paper to show how Realism, as opposed to Verbalism, may be made to pervade all the teaching of Geography; to point out prevalent errors in its treatment; and to exemplify shortly certain illustrative and dramatic methods, demonstrative at once to both eye and mind, which are both simple and cheap, and therefore easily at command in the poorest schools. The different points treated of can only be very briefly indicated; but this may be sufficient to help earnest men, of whom in the profession there is no lack, to more educative results in this most interesting but ill-used subject.

A.—REALISTIC TEACHING IN RELATION TO PREVALENT DEFECTIVE METHODS IN GEOGRAPHY.

As in all good teaching, our aim here should be the grasping of realities as against the conning of mere words; accuracy in contrast to looseness; clearness as opposed to vagueness; intelligence instead of grind.

I.—REALITIES *v.* WORDS.

The greatest evil in teaching Geography is the over-use and abuse of Verbal Memory, the glib but empty employment of words without any real knowledge of the things they represent. Every examination furnishes abundant illustration. Pupils will speak of "coarse linen," and yet know nothing of what it is, nor be able to name examples; nay, often they will tell you that "coarse linen" is "jute," both being associated with the same town on the Tay. So on all through—the *word* given, the *thing* little or not known, and still less realised.

1. *See that the Things are taught as well as the Words.*—Show to the children the substances and objects spoken of in all possible cases. As Rousseau tells us, "Things themselves are the best explanations." Exhibit the productions talked about, pictures of the animals, the peoples, the scenes, and the rest—and materials are, happily, now abundant and cheap—and show these to all the classes, even to the highest. It is wrong to think that such object lessons should be confined only to the lower classes.

2. *Use the Map in all teaching of Locality.*—Such a counsel would seem to outsiders to be quite unnecessary, and the use of the map to be universal. It is far from being so. It is common, in reporting, to have to say that memory work has been abundant and laborious, while the map has been little or not at all known! I have had to do so hundreds of times, and had again to repeat it last week. It is very usual to get lists of capes, mountains, rivers and towns asked; and given with painful thoughtless tripping off the tongue, and not one of them pointed out on the map.

"Enumerate the capes on the East Coast of Scotland." "Give all the towns engaged in tweed manufacture." These you get parrot-wise repeated, and none of them pointed out! Incredible, but true. It surely requires neither explanation nor urging to see that every place-name used by the pupils shall be pointed out by them on the map.

II.—REALITIES *v.* ERRORS.

The amount of misconception in the minds of pupils is perhaps greater in Geography than in most other subjects; it is certainly much more than is generally thought, as daily exhibited to careful examiners bent on realism. For example:—

1. *Regarding the lines on maps.*—These are often thought by children to be real objects on the earth's surface. I thought so myself as a boy for many a day. I once asked a class how I was to get my ship across the great black line of the Equator, for there was no way round. The answer was a revelation of much of what geographical teaching is. "Lift it up, sir, and go below it!" promptly shouted a smart little lad, suiting the action to the words with his two hands. The true nature of these lines, as existing only on maps for measurement purposes, should be carefully explained.

2. *Regarding the real nature of a map.*—The most curious ideas are entertained by children on this point, as may at any time be discovered by questioning them on the subject. Its relation to a picture, and the meaning of the different marks used for different features, should be fully explained; and care should be taken, by cross-examination, to see that they are *really* understood.

3. *Regarding the real directions on a map.*—The north many pupils think is *up*. They cannot help it, unless the subject is properly taught; and this common error is by no means confined to lower classes.

4. *Regarding the real directions in nature as compared with those on a map.*—Often where the directions are known *on the map*, their relation to the school-room and the country round them is too little taught. How seldom does an examiner find a class able to point out which side of the school-room is north, and which south; or how a person could discover the north and south during the day in a place he did not know! Yet surely such elementary notions, which can be simply taught and easily understood, should be known by every child. They are not.

5. *Regarding the possibility of our living on a round globe.*—The pupils see the globe called the earth either on a stand or on the walls; and their inquisitive minds are in active wonderment how men can stick on to the world with heads upside down; how the water does not run off its surface; and a hundred like difficulties, forced on them by the globular representations continually staring them in the face, in school. Most of us can recall such infantine problems, and even later ones of gravest difficulty, presented to the young philosophers, and attempted to be solved in vain. Error and misconception are here rampant in schools.

And so on with many other things that might be mentioned in the broad geographical field.

III.—REALITIES *v.* VAGUE AND INACCURATE NOTIONS.

1. *In loose description of localities.*—One daily hears that such and such a place is “in Inverness-shire,” “in Argyll,” “on the east coast,” “in the south of Scotland,” “in the eastern hemisphere,” “in America,” and the like; instead of a precise notation of its position, which it is one of the aims of good geographical teaching to secure; the teacher being satisfied with nothing short of perfect accuracy, by tongue and pointer.

2. *In loose pointing out on the map.*—It is the commonest thing to see pointed out the name of a town, a cape, or mountain, instead of the very place itself; to have the name of a river or its mouth shown, instead of having the river traced from source to mouth, which alone is satisfactory; and so on and so on. It is insufficiently realised by teachers, and it is much less practised by pupils, that there are necessarily three kinds of pointing out on the map—those of

(i.) *The point*, as in towns, capes, peaks;

(ii.) *The line*, as in rivers, coasts, mountains;

(iii.) *The superficies*, as in boundaries, lakes, seas. Each species has of course its own style of pointing out on the map, and each should be carefully discriminated and rigidly exacted.

3. *In loose questioning.*—It is a frequent pain to listen to such questions as these: “Any cape on the east coast?” “Any town on the Thames?” “Any mountain in the Highlands?” “Any river in Asia?” Could anything be more vicious in any subject, especially in a subject where the central idea and aim should be absolute accuracy in question and answer—a precise demand with one precise and only solution. In truth, it should be put down as a maxim in most teaching, certainly in Geography,—Banish the word “any” from all questions.

4. *In loose ideas of proportionate areas on maps.*—The different scales on which maps are made are not sufficiently explained, and the result is an incredible amount of erroneous notions in regard to the relative sizes of countries, especially as the native county and country are given on such a large scale, for clearness. These errors should be corrected by constant reference to one scale, in the maps of the world, or by other means, as now given on good text-books and in good maps.

B.—REALISTIC TEACHING IN THE INITIATORY STAGES.

Here, as in most subjects, initiatory notions are all-important, as affecting future progress and colouring all after-study. If they are not absolutely clear and true, disability lurks all through the course.

I.—THE DEFINITIONS.

1. *Of phenomena on the plane.*—A very effective method is to form the various features in the sight of the children, and still better with their help, by means of water poured on the table, or on the floor, or on a board

laid on the floor. In this way, all the relations between land and water may be graphically exhibited—*island, cape, peninsula, coast, isthmus, continent; sea, ocean, bay, gulf, strait, channel.* *Demonstrate* the phenomena by observing each of them; obtain the definitions from the pupils themselves, by questioning; write them on the board, and have them repeated simultaneously and singly till learnt—all the while directing attention to each feature thus defined, as shown to the eye by your artificial ocean and continent. With young children, use only the simpler words and features at first, gradually introducing the more difficult.

2. *Of phenomena in relief.*—Use clay, sand, and gravel, and form the features with the help of the pupils. It is a use of the Modelling so commendable in the Kindergarten, and is effective, interesting, and educative. By these means, form *hill, mountain, peak, range, chain, group; valley, glen; plain, table-land, desert; watershed or waterparting; highlands and lowlands.* Utilise simple Etymology where possible.

3. *Of river phenomena.*—Show these by pouring water on the head of the valley of clay, and noting its course to the sea, the water on the table. In this way, form the stream or river, its source, its banks; its course, its mouth, its tributaries, or feeders, and its basin; a confluence or meeting of waters, a waterfall, a delta, a firth, etc.; and lakes in its course. If the model is made in hard clay, the phenomena can be very effectively shown by pouring water on it from the rose of a watering-can in the way of rain, and noting what it proves—such as the run of water to the lower levels and to the sea, the formation of tributaries and lakes and deltas, according to the shape of the land through which the streams flow, etc.

4. *Of human arrangements.*—Countries, nations, counties; towns, villages, cities; roads, canals, railways; ports, harbours; bridges, piers, etc. These can be shown with all the interest of a game by means of toy houses, churches, bridges, carriages, engines, and the like; and by the use of coloured chalks and the paint-brush.

The ideas thus drawn from actual things done before and by the pupils, should then be further illustrated by picturesque diagrams of the definitions, of which there are now very good examples published. The chief point is to see that the ideas they have received are real and true; and that the definitions are clearly understood, as well as learnt.

II.—THE DIRECTIONS OR COMPASS POINTS.

1. *Fix the south* by turning to the sun at mid-day (*South*=the solar or sun quarter). From this, find all the other directions or cardinal points; first north, then east and west.

2. *Fix these directions in the school-room.*—Mark their names or initials on the wall, and draw them by a cross on the floor, with the appropriate letters. They are sometimes shown on the roof in schools; and in one case in Glasgow, by means of brass bars inserted in the granolite at the school threshold.

3. *Show how the top of a map is north.*—Lay the blackboard on the floor, and mark there the true directions thus found. Then place it on an easel, and show how north is put to the top; but that north does not mean up or higher than the rest, but is only put there to be well seen and for convenience; and that all maps should really be laid on the floor, in their true directions.

4. *Explain the principle of naming the other points*, by describing each by means of the two between which it lies. Thus a place between N. and E. is both N. and E., and is, therefore, shortly said to be N.E. So with the other middle points, N.W., S.E., etc. Later, extend this principle to N.N.E. between N. and N.E.; and to all the others.

5. *Introduce the compass.*—At first, reckon it as pointing true north, and show its value and use in indicating direction. Explain its name by showing that the directions *pass* all round the circle (as in the verb *to compass* a place). Hence that these directions are called the points of the compass. Later on, when the reason can be understood, explain the deviation of the compass from true north, the numbers of degrees of deviation, and its variability.

III.—THE TRUE IDEA OF A MAP.

1. *Draw a plan of the table.*—Do this on the blackboard placed on the floor, getting the children to direct the laying down of every line. First have the table bare, and draw its outline; then place some articles in it, as the ink-bottle and books, etc., and draw these in proper shape and place on this plan. This is simpler and clearer, as an introduction, than what is often recommended—a plan of the room,—which is too elaborate and too large at first, and somewhat difficult for young children to understand, from their being seated within it. Then lift the board from the floor to the easel, and show why this position is necessary, and its effects.

2. *Draw a plan of the school-room floor*, with its walls, doors, etc., desks, chairs, etc.—being always guided by the pupils—first, when on the floor or table, and then when raised to the easel.

4. *Draw a plan of the features on the plane, in the water-model used for the definitions.*—At first, let the features modelled be few, and let these be carefully traced on the board. We are thus gradually introducing them more nearly to a true map. Of course, at first, only put on the plan drawn the features on the flat. Here also, first have the board on the floor, or on another table; and then, elevated, to be seen. Begin with the land and sea features, then include the river and its tributaries.

4. *Insert in the plan of the features in relief on the model.*—Thus we introduce them to the need of having special marks to indicate mountains and plains, table-lands, land and sea, shores, towns, roads, etc. Make each of these marks first on the board, then insert them on your plan, and point them out on some distinct map hanging on the wall.

5. *Distinguish between a map and a picture.*—Discriminate between the

two by showing a picture and a map of the same features or room or country. There are some good diagrams published for this purpose.

6. *Insert the true directions* on the plan and map, when each is executed, by means of the usual signs; and show how the top becomes north, and so on.

7. *By and by, show the need and nature of lines of measurement.*—Draw them on the plan of the school-room, say at each yard, both along and across. Point these out on maps, and expound their use. Explain how they exist only on maps, not in the things themselves.

IV.—LESSONS ON THE GLOBE.

It is peculiarly difficult for a child to grasp truly the idea of a sphere or globe as that on which we live. All his notions of the possible are confounded; and, when we think of it, it cannot be otherwise. Strangely, the difficulty of the subject does not seem to have been sufficiently considered by teachers. They too readily assume it to be plain and easy, and actually begin lessons on the earth by means of a globe in the Infant room! Such lessons should be postponed for some years, till expanded knowledge of things and some ideas of gravity will prevent or lessen misconceptions, which are sure to follow too early on unskilful teaching here.

V.—WHAT ELEMENTARY GEOGRAPHY OUGHT TO BE.

1. *Teach it as a series of object lessons.*—Of course, and decidedly, there should be no text-book, which should be banished, as a forbidden spectre, for years. The subject should be presented in a succession of lessons on real things, from the simplest notions to the more complex; the teacher having a well-arranged expanding plan, though never formally obtruding it. The central aim is to make all the notions of the pupils on the subject absolutely firm, realistic, and accurate, by seeing and handling the things spoken of at every stage. The facts communicated and evoked should, of course, be suited to the age and capacity of the pupils, being at once simple, telling, interesting, and correct. If the idea of early Geography being simply a unified series of object lessons, governed by the principles of such lessons, were more practically realised and acted on, the subject would be redeemed from most of its present lamentable bad teaching at this stage; and we should make it possible and desirable to have it one of the very earliest subjects to be taught in the Infant room.

2. *See that all lessons are short and thoroughly conquered.*—Here, as in all early teaching, no lesson should exceed, at one time, fifteen or twenty minutes. It should embody one or two specific points, to be grafted into the pupils' minds; and should be thoroughly and frequently revised till it is thoroughly and permanently grasped.

3. *Move slowly but surely.*—One evil that pervades most teaching is that we proceed too fast. We attack new forts without silencing those in our rear, and thus allow ourselves to be harassed throughout by an

unconquered enemy. And this is true of Infant work as much as of more advanced, and relatively to the capacity, more so. Let every point be thoroughly mastered before another is attempted. Haste is impossible in good teaching.

4. *Graduate the technical terms used.*—All technicalities are difficult to all learners, as adults know when they begin a new subject, especially a science; which Geography truly is. Happily, here there are numerous duplicate terms, many of which are easy; and the easier should, of course, be only used for a time, till their more difficult technical equivalents are gradually introduced. For example, use "point," "nose," "head," and "headland," before "cape," or "promontory"; "neck" before "isthmus"; "a narrow" and "channel" before "strait"; "shore" before "coast"; "inlet" before "bay" or "gulf"; "table-land" before "plateau"; "water-parting" before "water-shed"; "feeder" before "tributary"; "meeting of the waters" before "junction" and "confluence"; "spring" before "source"; and so on. In fact, for a long time, only the simpler vocabulary should be employed, till the connection between the real things and their names is firmly and intelligently established.

5. *Write on the board all the technical terms used.*—If necessary, print them; but present them both to eye and ear. Get them also copied. While repeating them, see that the pupils look at them, so that sight and sound are wedded. Thus we should teach not only Geography well, but English; and help reading and spelling.

6. *Utilise Derivation at this stage where possible.*—This can be done from the first more than may be supposed likely—always, of course, in the hands of a wise and informed teacher. Do not introduce Etymology proper, but only the simpler root words in plain English, where such are available. For example, show that "island" defines itself, being simply "is-land"—water-land (connected with *aqua* and its cognates, the *s* being an erroneous interpolation from *isle*, but, of course, here we do not bother the child with that); and that "continent" is so named from *containing* so many countries, etc. In a similar fashion, connect "cape" with cap; "ness" with nose; "channel" with canal; "bay" with bow; "creek" with crook; "promontory" with prominent; "belt" with a belt; "peak" with beak; "plateau" with flat and plate; "water-shed" with the shed of the hair; "confluence" with flow; "strait" with a stretched, and therefore narrow, piece of india-rubber; "desert" with deserted; "lagoon" with lake; "tributary" with paying a tribute of water; "firth" with ferry; "sound" with swim; "range" with rank; "haven" with have. Many of these words should be postponed to a later stage. Such terms as the following explain themselves, but even the meaning of such obvious words should always be drawn attention to:—head, neck, point, bed, breakwater, waterfall, banks, chain, plain, sandbank, headland, highlands, lowlands, etc.

7. *Get the definitions from the pupils.*—These should be led up to and

proved, as in the demonstration of a problem. The words of the children should be always utilised, and made the basis, by gradual correction, of the final form; which should be learnt. The definitions thus received are often striking, original, and interesting. For example, a boy was shown a large map of the Pacific, with its deep, blue, expansive sea, and its little bits of land like specks in its midst; and the nature of these pieces of land, as connected with the water, was pointed out. When asked what an island was, his answer was at once quaintly Irish, but quite philosophical—"An island is a portion of sea with no water into it!"

8. *Use diagrams for illustration*—in addition to the tangible demonstrations you give. These are now graphic, instructive, artistic, and abundant.

9. *Discard all text-books.*—Cast far from you and your children with disgust all so-called "Elementary Geographies." They are in general monstrous, and their compilers educational traitors to childhood. The recipe for their manufacture seems to be this: Take an advanced Geography, squeeze out of this poor orange all the juice, then force the child to swallow it. Happily a delightful change has very recently taken place in elementary books, especially those for the new Code of 1886. A few of these are really simple, and finely illustrated. *Some* of these *might* be judiciously utilised by a good teacher, at least, for their pictures; but their use is attended with danger, with most teachers.

C.—REALISTIC TEACHING IN THE USE OF MAPS.

I.—DEDUCE GEOGRAPHICAL FACTS AS MUCH AS POSSIBLE FROM MAPS.

All facts, topographical, social and political, that can be so obtained, should be learnt by a careful examination of the map, under the guidance of the teacher. In truth, it should be put down as a central principle of practice, to tell nothing, and to ask nothing to be learnt from a book, that can be got by observation of the map. On the map, we have the facts and features presented to the eye in their natural relations to each other, with the aid of the faculty of locality and of their proper surroundings, physical and social, to fasten them to the memory. By skilful questioning, also, much additional and valuable matter, besides that seen by eye, can be obtained from the children.

As I have heard my friend, Mr. John St. Clair of Newton Stewart, the best teacher of Geography I have known, wisely suggest, the text-books of the future will be, more a series of skilful questions on the facts presented on good maps, than the present forbidding lists of names and statistics in a book. The man that achieves such a text-book will inaugurate a new era in Geographical teaching. Mr. St. Clair should himself be the first to do it—to show its nature, prove its wisdom, and exhibit how educative and intelligent the plan may become in good hands.

II.—SUBORDINATE THE USE OF THE TEXT-BOOK.

The text-book has been one of the chief causes of "the worst

ways of teaching Geography," so justly satirised and condemned by Professor Meiklejohn; it has been the curse of the subject and the scholar. Think of learning the endless, nauseous lists there presented. And they are learnt by mere rote in this way, more than most folks, including most teachers, would think; so much so, that one is tempted to recommend that text-books should be thrown entirely aside.

All true geographical teaching can only be done by the paramount use of the map and the tongue, and by the firm subordination of the text-book in the hands of the scholar. But in their own place, text-books have their uses. They are a means of revising what has thus been learnt through the eye and the ear; of presenting clearly the various words used, many of these being new, difficult, and foreign; of adding facts not obtainable from the map; of furnishing illustrations of the scenes and objects spoken of, as, happily, so many of our recent Geographical Readers now abundantly do; and in other ways, that might be mentioned. But it cannot be enough urged, that the map should be made the main source and means of geographical teaching, and that the book, reduced to its true level of an auxiliary, should be sparingly and wisely utilised.

III.—DISCRIMINATE TWO PERIODS AND TWO PURPOSES IN THE USE OF THE MAP.

1. *In learning facts, the map should be placed near enough to allow the pupils to read the names.*—This of course, from the principles just explained; because they are to obtain from the map as much as possible. Hence the map used in teaching should have the names clearly exhibited, so as to be easily seen by the pupils. The use of *blank* maps at the *learning* stage is objectionable, as they show only the features without the names. Blank maps, especially when they exhibit the features boldly, are not, however, to be discarded at this stage. They may, rightly used, be of value in teaching. But what I contend for is that the names of places and phenomena should be *learnt* as presented on the map and not from a book.

2. *In testing knowledge, the map should be far enough distant to prevent the pupils reading the names.*—If they are able to read the names, there is no security that they really know them. Therefore, have the map so distant that they cannot read them; or, what is much the same thing, cover the names, when you wish to see if they are really known. Yet I have seen many schools where the pupils were allowed to read the map all the year through, and where they broke down when they were prevented reading them at the examination! In many reports, I have had to state that the map was more or less, and sometimes altogether, unknown, while memory facts were well known. In such cases, I have always put it, that it was not the pupils who know the Geography, but the map, which is always good at the subject.

In this test stage, the value of *blank* or *skeleton maps* is very great, as they render the tests perfect, and save trouble to the teacher. There are

two kinds of blank maps—one where the whole of the features and places are laid down, minus the names; and the other, of black material, which can be used like a board, on which the teacher can insert these under the dictation of the class. The latter are, of course, the better, and in every way, the most thorough test. I have seen skeleton maps painted on common black boards most effectively. Such board-maps can be purchased, but they can easily be made by the teacher himself, by sketching or by pricking an old map through when fastened to the board, and afterwards painting the pricked lines.

IV.—IN TEACHING THE GEOGRAPHY OF A COUNTRY, PRESENT THE FACTS TO THE PUPILS, AS FAR AS POSSIBLE, AS VIEWED FROM DIFFERENT STANDPOINTS.

1. Look at a full map of an unknown country, especially one with numerous physical and political facts. How crowded and perplexing it appears even to adult eyes, and how much more must it do so to those of children! To them, a map must seem a forbidding and inextricable maze, as they have generally been made for schools, until recent reforms have improved them. Hence the wisdom of presenting these crowded facts in groups, based on a succession of "standpoints," as they are best called. Such are:—(1) The external physical features; (2) the internal physical features; (3) the chief towns; (4) the minerals; (5) the manufactures; (6) the railways; (7) the commerce; and the like.

This plan recommends itself strongly, by all the principles of good teaching. It is doing in Geography what is done in all sciences, classifying the facts, and graduating their presentation to the pupils. Only see that the full map is at last presented to them, as they will have it in actual use. The knowledge and ready and accurate use of the full map are what is aimed at in the end; but we help the pupil the better to that end, by disentangling the complex whole for teaching and acquiring purposes.

There are now some very good examples of this system, which may be called "the standpoint system" of geographical teaching, such as Ruddiman Johnston's "World Series;" and an exceedingly good, clear, and cheap combined atlas and geography by Mr. T. M. Davidson of Dundee Academy (published by Menzies), "The Geography of England and Wales from Ten Different Standpoints;" and the same of Scotland.

2. *Guard against the Abuse of Classification.*—One of the chief errors in the teaching of Geography has been over-classification; learning, from a book or otherwise, lists of capes, rivers, countries, and the like. Reform lies in presenting these features to the pupils, from the first, as much as possible in the natural groupings—physical, social, and political—in which they really exist, and by which they throw valuable light on each other, all-important in good teaching. Hence the need of teaching and examining each district and country in the light of the mutual relations of the facts to each other. A good plan, therefore, is to revise, by sailing along a river, taking a voyage along a coast, or making a journey by railway.

The teaching of the railway system of a country is too much neglected. Railways are now more important than most rivers ; as being in modern life, a greater means of communication than rivers, or even the sea.

(Concluded in our next.)

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

AN Ordinary Meeting of the Society was held in the Masonic Hall, George Street, Edinburgh, on 14th February. Mr. J. Y. Buchanan, of the *Challenger* Expedition, read a paper on "The Slopes of the Ocean-bed on the Coasts of Islands and Continents," which will be published in a subsequent number of the Magazine. Mr. Alexander Buchan, Member of Council, presided, and the vote of thanks to the lecturer was moved by Mr. James Currie.

Two public meetings were held in February under the auspices of the Society and other public bodies to consider the question of "the Title-Deeds to Nyassa Land," which was discussed in a paper read on the occasions by the Rev. Horace Waller. The meeting in Edinburgh was held on 8th February in the Free Assembly Hall, the Right Hon. the Lord Provost of Edinburgh, Vice-President of the Society, being in the chair. There was a large attendance.—On 18th February another public meeting was held in Glasgow, in the Queen's Rooms, with Mr. Renny Watson, Convener of the Glasgow Branch of the Society, in the chair.

At both meetings, resolutions were adopted expressing satisfaction at the efforts which had been made to destroy the African Slave Trade, and authorising representatives to wait on the Foreign Secretary and urge Her Majesty's Government to propose to Portugal that the territory to the north of the river Ruo should be delimited for British influence alone.

GEOGRAPHICAL NOTES.

EUROPE.

On the Ancient Iron Industry of Scotland.—In a paper read before the Society of Antiquaries of Scotland, 13th December 1886, Mr. Ivison Macadam stated that, beyond scattered notices of the discovery of masses of cinders in various parts of the country, little or nothing was known of the iron industry of Scotland in ancient times. Led by the discovery of several of these mounds in Argyllshire during the summer of 1881, he had been induced to go fully into the matter. Originally it was intended to treat the matter chemically only, but the enormous mass accumulated of historical and other facts rendered a more exhaustive paper necessary. A list of nearly one hundred bloomeries had now been obtained, and was being added to day by day. These works might roughly be divided into those which used only ore and fuel, and those which added a flux also. In the first case the slag was dark, whilst the second series gave light lime slags very similar to those now obtained in ironworks. The works used in most cases bog-iron ore, but occasionally red iron ore was employed, and even clayband ironstone. The two latter ores were usually imported from England, and it was very rare to find local ores other than the bog-iron ore used in these works. The fuel used was wood or peat ; charcoal and large quantities of

both materials could be obtained on the sites of these old ironworks. Mr. Macadam then described in detail the processes which had been used, and exhibited specimens of the slag, charcoals, iron ores, and metal made by the processes, and found in the refuse of the bloomeries. He also quoted documents to show how well known the west of Scotland especially was to the English ironstone masters during the reign of Queen Elizabeth. Mr. Macadam is still collecting for the Society notices of unrecorded sites.

Italian Emigration.—From an interesting pamphlet (*Sul Movimento dell' Emigrazione dall' Italia*, Rome, 1886) recently published by our Honorary Corresponding Member, Signor Luigi Bodio, we take the following facts:—Italian emigration is of two kinds. The one consists of persons who leave their native land with the intention of settling more or less permanently in some foreign country beyond seas. The other embraces those who periodically leave their homes for the sake of procuring work elsewhere, just as the Irishmen come to England to help get in the harvest, and as numerous bands of labourers move from one government to another of Russia during the summer months. This last class of Italian emigrants are mostly masons, stonecutters, and navvies, who proceed to Austria, Switzerland, Germany, France, Corsica, and Algeria. They go mostly from the northern provinces—Venice, Lombardy, Piedmont—setting out in spring and returning in autumn. Italians are in great demand in all those countries as labourers for the digging of canals and the construction of railways. This class of temporary emigrants amounts to from 80,000 to 100,000 per annum: in 1883 the number was 100,000, in 1884, 89,000, and in 1885 it fell to 80,000. Emigration properly so called has increased from about 20,000 in 1878 to 40,000 in the three following years; in 1882 it amounted to 66,000, in 1883 to 68,400, in 1884 to 58,000, and in 1885 to 77,000. These emigrants come principally from Liguria, Naples, Venice, Lombardy, and Piedmont, and go for the most part to the Argentine Republic (37,710 in 1885), to Brazil (12,311 in 1885), to the United States (13,096 in 1885), and to Uruguay (1497 in 1885). Thus the great majority proceed to South America. Taking the figures for the year 1885—of the total number of emigrants of both kinds—21·27 per cent. went to France, 10·79 to Austria proper, 6·84 to Hungary, 2·91 to Switzerland, 2·88 to Germany, 5·08 to other countries of Europe. In all, 50·23 per cent. belonged to the class of temporary emigrants, and 49·77 per cent. were permanent emigrants. Of these last 25·48 of the total number proceeded to the La Plata states, 7·83 to Brazil, 8·33 to the United States. Classifying by age and profession, and taking into account the total number of emigrants in 1885, it results that agricultural labourers numbered 70,039 (50·32 per cent. being men and women above fourteen years of age); porters and other day labourers, 29,428 (21·14 per cent.); masons and *scarpellini* (sculptors' assistants), 15,823 (11·37 per cent.); artisans and operatives, 12,506 (8·99 per cent.). This heavy emigration does not by a long way carry off the increasing surplus population; for whilst the births exceeded the deaths at the rate of 11·54 per thousand in 1885, emigration took off but 2·69 per thousand. The corresponding figures for France in the same year were 2·32 and 0·16; and for the United Kingdom, 12·33 and 5·72, made up as follows:—England and Wales, 13·50 and 4·59; Scotland, 13·18 and 5·47; Ireland, 5·11 and 12·20.

ASIA.

MM. Bonvalot and Capus.—The *Bulletin de la Société de Géographie de Marseille*, 1st quarter, 1887, announces the receipt of a letter, dated from Samarkand,

6th November, and addressed by *M. Capus* to his father, stating that *MM. Bonvalot* and *Capus* have been set at liberty by the Afghans, after a captivity of three weeks, and that the intention of the travellers is to return to France immediately.

French Population in Tonquin.—The French population in Tonquin on 30th May last year numbered 657 individuals—530 males, 70 females, and 57 children. The French population of Hanoi was 334; Haiphong, 182; Sontay, 41; Bac-ninh, 31, etc.

News of Dr. Neis.—The Paris Geographical Society have received good news of Dr. Neis, who, writing from Hanoi, 21st October 1886, reports the acquisition of valuable geographical information in regard to the countries situated between the Black River (Lysien or Nam-Thé) and the Mekong.

MM. Potanin, Scassy, and Beresowsky have returned from their expedition in China and Mongolia, bringing with them vast zoological, botanical, and ethnographical collections, as well as maps of the regions visited by them during the three years 1884-86.

Russian Polar Expedition.—The St. Petersburg Academy of Sciences has received from Dr. Bunge, head of the Russian Polar Expedition to the New Siberian Islands, the following brief despatch from Orlinga, a telegraph station situated on the route to Yakutsk, between Jigalova and Omoloi:—"The expedition has been a success. We spent the summer in the two islands—Bunge in Great Liakhovsky, and Toll in Koteluy. During the spring all five islands were explored, New Siberia specially by Toll. We reached the mainland again towards the end of October. All the members of the expedition are in good health. The scientific results are of considerable value."

AFRICA.

Morocco.—The January and February issues of the *Revue de Géographie* print a list, by M. de la Martinière, of maps of Morocco, accompanied with a brief description, giving details as to scale, source, date, etc. Several are described from the British Museum collection.

Signor Julio Cervera Baviera, an officer of the Spanish Navy, commissioned by the Madrid Society of Commercial Geography to explore the Western Sahara adjoining the Spanish possessions between Cape Blanco and Cape Bojador, returned to Spain towards the end of last year. His companions were Professor Don Francisco Quiroga, who devoted his attention to the meteorology, geology, flora, and fauna; and Don Felipe Rizzo, Arab interpreter. The expedition went as far as Adrar, traversing a total distance of 568 miles, through districts almost entirely unexplored previously; the highest altitudes crossed were 1400 feet above sea-level. Two treaties were concluded with Arab chiefs, whereby Spain acquires a vast addition of territory. Signor Baviera announces a detailed account of his travels.

The Emin Pasha Relief Expedition.—The following telegram, dated Zanzibar, February 24, has been received from Mr. H. M. Stanley:—"I have embarked the expedition on board the *Madura*, being occupied the whole day. It consists, on its departure from here, of 9 European officers, 61 Sudanese, 13 Somalis, 3 interpreters, 620 Zanzibaris, the famous Tippu Tip, and 40 of his people. Couriers have gone overland with letters to Uganda, and others to Stanley Falls. Tippu Tip's force will proceed from Kasonge and Tanganyika Lake to Stanley

Falls to meet the chiefs. If in time, the Arabs will march with me to Lake Albert; but the advance force will push on to Wadelai, the third day after its disembarkation at Stanley Falls, regardless of all other arrangements, the object of concentrating a large force, of course, being the transport of ivory from Lake Albert towards defraying the expenses, and of the women and children of the Cairo Arabs. I hope to be able to reach the Cape by March 9 at latest. Telegrams from Europe will reach me there. Good-bye to you."

Congo Expeditions.—Two more expeditions have been organised by the Congo Company. The first, composed of engineers and topographers, are charged to examine the country between Matadi and Leopoldville, with the view of ascertaining the best route for the proposed railway. The second, consisting of land-surveyors, geologists, and commercial agents, are to examine the Congo above Stanley Pool. The command of this party will probably be given to *M. Delcommune*, who ten years ago acquired much experience of African commerce on the Lower Congo.

Exploration of the Nkissi.—This river is one of the most important left-hand tributaries of the Congo, joining it near the village of Nzélo, in the district of the cataracts, 30 miles below Leopoldville. It has recently been explored, for the first time, by the Swedish Lieutenant Hakansson and Baron von Schwerin. The general direction of the Nkissi for 50 miles above its confluence with the Congo is south-east. Proceeding towards its source, its upper course, which has not yet been explored, seems to follow, south, east, north, and west directions. In its lower part it is not navigable, owing to a series of falls, extending as far as the village of Gongolo, along which the river cuts its way through the terraces that lie parallel to the Congo. Beyond Gongolo the riverine parts of the country stretch out into fertile plains, well wooded, and populous, with large palm and other trees, an abundance of grass, and a number of well-fortified villages, such as Kileufi, Niongo, Kolondo, Banza-Lenghi, Bembé, Kimpanda. The chief place of the region is Moala, a great ivory centre. The population consists of Muchikongo, with Bakongo interspersed. They had never before been visited by white men; but they seemed hospitably inclined, except at Gongolo. On 15th November the two explorers reached the station of Lutété, having set out on the 1st from Leopoldville.

Baron von Schwerin, on continuing his journey towards Lukunga, passed and ascended the mountain Bidi. This is the name given to the highest peak in the Ndunga Mountains, a fertile plateau, five or six miles square, traversed by numerous streams, and occupied by populous villages, whence the Congo Free State obtains many of its porters.—*Le Mouvement Géographique*, Jan. 16, 1887.

Further Proof that the Wellé is a Tributary of the Congo.—The theory connecting the Wellé with the Congo, ingenious as it was then novel, was published in 1885 by *M. Wauters* in the *Mouvement Géographique*; and we gave our readers an account of the main features of the argument in the Magazine for October of that year. *M. Wauters* holds that the identification is now all but fully made out, and has discussed the new material in the *Mouvement* of January 30th.

Amongst early and important converts to his view that the Wellé, rising on the watershed of the Nile tributaries, did not flow to Lake Chad, but entered the Congo by the Mobangi, then newly explored by Mr. Grenfell, *M. Wauters* reckoned Schweinfurth, Stanley, Grenfell, and Lenz. French geographers—notably *M. de Brazza* and *M. Duveyrier*—disputed the Belgian geographer's conclusions; and on the arrival of Dr. Junker at Zanzibar, the French Vice-

consul wrote to Paris that Junker had no doubt that the Wellé did actually flow to Lake Chad. As Junker had just come from exploring the Wellé, and had reached a point much farther west than had heretofore been approached, the French geographers were triumphant. And the question of the limits of the Congo basin and the Congo Free State is of no small importance for the ultimate settlement of the boundaries of the French possessions between the Gaboon and the Congo. But *M. Wauters* did not lose heart; and, on receipt of a letter from Dr. Schweinfurth at Cairo, triumphed in his turn.

On Junker's arrival at Cairo, Schweinfurth found that, when at Zanzibar Junker knew nothing of Grenfell's Mobangi, or of any northern tributary of the Congo save the Aruwimi. As soon, however, as the facts discovered about the northern affluents of the Congo were laid before him, Junker recognised the probability of the Wellé-Mobangi-Congo theory, and professed himself "entirely convinced" that *M. Wauters* was right in his brilliant hypothesis.

Junker followed the Wellé (there called Makua) to the village of Bassanga, in $22^{\circ} 47' 40''$ E. longitude, and $3^{\circ} 13' 10''$ N. latitude, only about one degree north of the Congo. Now, as Grenfell followed the course of the Mobangi to $4^{\circ} 40'$ N., it follows either that the Wellé-Makua makes a great bend to the north-west ere it turns southwards as the Mobangi towards its embouchure in the Congo, or that the channel explored by Grenfell is another branch of the Mobangi. To this latter view, *M. Wauters* inclines as the most probable, and holds that the Mobangi is constituted by the Wellé-Makua coming from the east with a course nearly parallel to the Congo, and another river, probably of smaller length and volume, the Genko-Kuta (Grenfell's branch), coming from the north. Grenfell found the course of the Mobangi much encumbered with islands; and *M. Wauters* supposes, probably enough, that Grenfell may have passed without noticing the confluence of the Wellé-Makua with the Gedko-Kuta, whose course he followed upwards to $4^{\circ} 30'$ N. What still remains to be done towards the final solution of this interesting problem is that somebody should pass down the Wellé-Makua from Bassanga into the lower Mobangi, or sail up from the Congo to Bassanga. Dr. Junker reports that on the part of the Wellé explored by him there is no obstruction to navigation lower down than the falls of Kissinga, visited by Schweinfurth, in the upper part of the river's course. He regards the Wellé-Congo as the most direct and perfect water-way towards the Egyptian Sudan, and expects that, if Stanley starts by the Congo to the relief of Emin Bey, he will find the Wellé-Makua his best route.

Germany and Portugal in Africa.—The negotiations between these two States with respect to their territorial possessions on the West and East Coast of Africa are at length concluded. That is to say, the Governments have come to an agreement, which, however, awaits the sanction of the Portuguese Cortes before being definitively converted into law. The southern boundary of Portuguese Angola is settled as follows:—Starting from the second cataract of the river Cunene, in the Chella or Canna Mountains, the frontier line runs parallel to that river as far as the Cubango, which stream it then follows southwards to Andara. From this point it coincides with the parallel of latitude as far as the Zambesi, crossing this river at the source of the rapids of Colima. The northern boundary of Mozambique is coincident with the course of the Rovuma as far as its confluence with the Msinge; thence it proceeds direct to the shore of Lake Nyassa.

German Colonisation in Africa.—The November number of *L'Afrique* contains

an article summarising the recent steps of the German Government towards the acquisition of colonies on the coast of Africa. The colonising movement is attributed to the desire of Germany to provide profitable fields for commerce and emigration. Before any part of Africa had been appropriated, German merchants had acquired a permanent footing on the West Coast. In 1882 and 1883 there were eleven Hamburg firms, and three from Bremen, with one hundred factories, holding their own against British merchants in British Colonies. In Lagos, for example, in 1881, there were only three German and as many as nineteen British firms, yet the total imports of merchandise from Germany amounted to £106,341, and from Great Britain to £160,487 only. For the whole coast from Liberia to Namaqualand, British imports in 1881-82 amounted to 32,625,000 francs, and German to 28,375,000. In 1883 there were thirteen steamers running regularly between Hamburg and the African West Coast.

On August 26, 1882, a large and influential meeting held at Frankfort-on-Maine decided that a Society should be founded for the promotion of the colonising movement, and, on December 6th, the German Colonisation Society was inaugurated accordingly. Sections were formed in the various German States, and great enthusiasm was shown everywhere.

Angra-Pequena was the first African territory to be placed "under the protection" of the German Empire; and, starting from it, new acquisitions were made, until now the whole West Coast from Cape Frio to the Orange River, and in the interior Namaqualand and Damaraland, are German colonies. Nor is this the end. Acting on the report of Dr. Peters to the Congress held in Berlin last September, for developing German industries abroad, negotiations are in progress for annexing the southern part of Ovambo, 170,000 square kilometres in area. Two companies, the "Society for German Colonisation in South-Western Africa," and the "German West Africa Company," have been formed to carry the project into effect. The former body is intended to pay special attention to the working of minerals (according to *M. Göring's* report copper is abundant), the latter to promote settlements of agricultural or cattle-raising colonists.

Whilst the other colonies are to a great extent private ventures under government protection, Cameroon is a colony of the Empire, with a governor and a "tribunal arbitral" of German settlers. The country is very fertile, and rejoices in an abundant rainfall; the climate is bad, however.

The importance of carrying trading outposts into the interior, and not confining commercial activity to a narrow strip along the sea margin, is fully appreciated, and it has been proved that such inland factories do not in any way diminish the amount of trade done at the coast—in fact, they lead to its increase. The Swedish factory founded by Messrs. Knutson and Waldan in Massanya, about three years ago, has been a great success, alike in a pecuniary way and in the increased comfort and activity of the natives, who have taken to work with pleasure. Stimulated by this, Dr. Schwarz proposes to establish a factory at Buéa, 20 kilometres beyond that of the Swedes, and another at Lissoka, 10 or 15 kilometres further. Both these are healthy situations, and well placed for traffic. Altogether, Dr. Schwarz thinks that there might be about 50 establishments between the coast and Upper Calabar.

Some opposition may be expected from natives, but this would easily be overcome by a small war-vessel cruising on the Mungo. Trade might be carried on by light steel canoes, built after the native model, armed with two guns, and capable of carrying 50 men and several tons of goods.

The Cameroon Colony might become the commercial route to the centre of

Africa. With this view, the German Government has sent out Dr. Zintgraff to explore the river systems in the little steamer *Nachtigal*.

The territory of Togo is at present being explored towards the north by *M. Gottlieb-Adolphe Krause*, and towards the south by *M. Falkenstein*. The former hopes to open up a way between the German colony and Salagha, which is a centre for trade with the Sudan and the whole basin of the Niger.

England and Germany on the Gulf of Guinea.—These two countries have recently demarcated more exactly the boundaries of their respective possessions on the Guinea Coast. In the interior the frontier line between the English and the German territories follows the right bank of the Rio del Rey, from its mouth to its source; thence it goes in a straight line to the left bank of the Cross or Old Calabar River, which stream it crosses, and terminates in about 9° 8' E. long., at the point marked Rapids on the Admiralty Chart. The Governments of both countries are also agreed to prolong the frontier towards the interior. The new frontier line shall, it is proposed, be drawn diagonally towards the left bank of the Benué, on the east of Yola, as far as a point which is to be determined subsequently.

Recent Topographical Work in Madagascar.—*M. C. M. Le Myre de Vilers*, Resident-General of France in Madagascar, has communicated the following useful information, relating to the recent topographical work in that island, to the President of the Topographical Society of France.

M. Roblet, Jesuit missionary in Madagascar, has been for some time engaged upon four maps of the island:—I. Map of the Province of Imerina, on the scale 1:300,000. II. General Map of Madagascar, on the scale 1:1,000,000. III. Map of Imerina, scale 1:100,000. IV. Map of Betsileo, scale 1:200,000. The first two are finished; but the last two are not yet completed. The maps of the provinces of Imerina and Betsileo have been prepared from the personal observations and travels of *M. Roblet*. These cover a region measuring about 310 miles by 95 to 125 miles, embracing the upper parts of the basins and drainage systems of the rivers which have their sources in the mountainous centre of the island. The real importance of the topographical work done by *M. Roblet* will be understood when it is added that these streams all radiate from the central massive plateau of Madagascar, and flow for the most part north, east, and south-west; whilst their valleys constitute the natural routes and means of communication between the coasts and the interior.

This part of the work was carried out by means of triangulation. A base-line about $3\frac{1}{2}$ miles (5600 mètres) long, was measured along the plateau of Maharemana, about half-way between Tananarivo and Lake Itasy. The horizontal angles were measured with the geodesic circle, and the interior details filled in on the plane-table. At the same time the opportunity was seized to make a series of meteorological observations, which will prove serviceable later on for the construction of special maps. By these means the positions of the summits belonging to the central mountain mass, of the passes and the villages, the directions of the rivers and the routes of communication, have been fixed. Nearly all the important streams of water were explored from their source to their confluence. In executing the plans he laid down, the surveyor visited 500,000 principal stations, forming the apices of his triangles; this network entailed the marking on the maps of about 200,000 secondary points in connection with offset work. When we call to mind the circumstances under which these arduous labours were performed—by a man who, for the thirteen years during which his task lasted, travelled everywhere on foot, with a scanty troop

of assistants, with very inadequate resources (scientific, pecuniary, and commissariat), moving through the midst of semi-civilised peoples to whom his calling as Roman Catholic priest was obnoxious, and by whom his proceedings were set down to sorcery—we cannot certainly refrain from a warm acknowledgment, not only of the brave priest's courage, but of his devotion to the cause of geography and science. And the permanent importance of his work stands out more clearly, because this is the first real attempt to delineate with anything like accuracy the interior parts of the island.

But in addition to these labours, the results of his own personal endeavours, *M. Roblet* has drawn up other maps, by the aid of materials gathered from reports and information placed at his disposal by travellers, sea-captains, and indigenes. The west coast was laid down in accordance with information furnished by sea-captains. On the east, the part between Andavoranto and Mahanoro was described by a planter of the district, *M. Guénot*; and the basin of the Ranola, a northern affluent of the river Iaroka, by another planter, *M. Maigrot*, who owns an estate on the latter river. The district between Mahanoro and Mananjara, as well as the itinerary from this latter town to Fianarantsoa, has been traced out by the Roman Catholic missionaries. Lastly, reliable details as to the northern portion, from the Bay of Antongil to the Bay of Pasindava, were obtained from two Malagasy prisoners detained at Réunion during the recent war. All these various informations were checked by other sources, and found to be correct.

It may be added that the map of Imerina has already been published in *De la Vaissière's Histoire de Madagascar*; and that the general map of Madagascar is now being prepared for publication by *Haussermann*, of Paris.—*Revue de Géographie*, January 1887.

AMERICA.

Greenland.—Herr *H. Rink* reports the following work done by the Danish exploring party in Greenland during 1886:—"Whilst the members of the expedition which explored East Greenland in 1885, after their return were engaged in working up the results of their expedition, the two naval officers, *C. Ryder* (leader) and *C. Bloch*, together with *V. Ussing*, the mineralogist, started on a journey to the northernmost district of Upernivik. They arrived at Godhavn on 15th June, and at Upernivik on 1st July. Owing to the time spent in making their preparations, and subsequently to bad weather, they did not begin their excursions until the 20th; but then they had the attendance of the recently arrived Danish warship, *Fylla*, with Prince Waldemar on board. They succeeded, before the frost came, in completing their examination of the inner navigable belt, as also of the great ice fjord of the Angpadlartok, on August 20th. They then intended, as long as a channel should be open, to travel along the outer line of coast, and to complete their explorations in winter and spring by means of dog-sleighs. Herr *Ussing* returned to Copenhagen in autumn of last year."

Volcano of Jorullo.—The *Bulletin de la Société de Géographie* (3^e Trimestre, 1886) of Paris contains an interesting account of Mount Jorullo in Mexico, by *M. Jules Leclercq*, which was ascended by him and *M. Fink* on 8th November, 1883.

Mount Jorullo is situated in the Mexican province of Michoacan, in 19° 9' N. lat., and 103° 51' 48" E. long., 108 miles from the Pacific Ocean. This volcano is of quite recent formation: living Indians have known old men who

remembered the time when the plain where the mountain now stands was covered with palm-trees, sugar-cane, and indigo. It rose up and was formed during one night, the 29th September 1759. The eye-witnesses of this stupendous convulsion, which in point of magnitude recalls the cataclysm of Krakatoa in 1883, relate that, from the summits of the mountains of Aguasarca, whither they had fled in terror, they beheld the earth, over a space of more than half a square league, veritably take fire. Gigantic sheets of flame shot up out of the earth; a vast multitude of incandescent stones were hurled to enormous heights, and fell earthwards again in showers of fiery rain; the pliant crust of the earth rose, like a convulsed sea, above the ancient level of the plain; whilst above all hovered a dense cloud of cinders and scorïæ, brightly illuminated by the fires of the volcano struggling in its birth-throes. The river San Pedro was shaken out of its bed, its waters being precipitated into the fiery chasm, where they became decomposed into their original chemical elements. The plain all round the volcano became embossed with thousands of miniature volcanic cones or *hornitos*, which emitted incessant columns of smoke. The activity of the central cone continued unabated until the following February (1760), after which its intensity gradually died away. The great volcanic outburst of September had not occurred wholly unexpectedly; for from the preceding March there had been several premonitory symptoms of subterranean activity in the immediate neighbourhood. Tremblings of the ground were repeatedly observed, and the atmosphere was frequently heavily laden with sulphurous hydrogen.

Jurillo belongs to the zone within which stand all the mountain peaks of Anahuac that rise above the snow-line. It seems highly probable that this volcano is connected with the extinct craters of Cutzarondiro, in the district of Tacambaro, and along the same volcanic line as that on which stand Popocatepetl, Nevado de Toluca, Tancitaro, and Colima. Certain it is that shortly before the formation of Jorullo the cones of Cutzarondiro were in full activity; and it is not rash to assume that, the craters becoming choked, the subterranean currents sought an outlet elsewhere, and found it in the new volcano 45 miles distant.

Although at the present time (1883) the mountain appears to slumber, signs are not wanting that some day it will very probably resume its activity. A week before *M. Leclercq* made his ascent, the inhabitants of the surrounding districts had felt violent shocks and tremblings of the earth, and had heard subterranean rumblings, which had also been noticed at Ario, 36 miles away. Also on the floor of the crater sudden subsidences are a quite common occurrence. Moreover, two months previously the mountain called El Cirate, near Quiroga, on the margin of Lake Pázcuaro, had subsided nearly 150 feet, effecting a rise in the *niveau* of the lake. One curious fact deserves special mention. The tremblings of the earth are wont to make themselves felt particularly on the approach of the rainy season. On days when the atmosphere is saturated with humidity a column of watery vapour, which is readily mistaken for a pillar of smoke presaging an eruption, forms above the summit of the volcano; it is, apparently, the result of the irradiation of the columns of hot steam rising from the depths of the crater.

When Alexander von Humboldt visited the mountain in 1803, forty-four years after its formation, the temperature of the hornitos was 203° Fahr. *M. Leclercq* obtained a maximum temperature of 152°6.

Mount Jorullo, the crater of which reaches 4315 feet above sea-level, rises 1640 feet above the plain on which it stands. In shape it is somewhat elongated in the direction east-west. The north side is bare and barren, the volcano having ejected an enormous quantity of scoriaceous and basaltic lava, containing fragments

of primitive rocks ; whereas the southern slope is covered with luxuriant vegetation from summit to foot, the guava growing along with the pine.

The plain lying at the foot of the mountain on its northern side is, as it were, inflated like a gigantic bladder, the surface consisting of lava and cinders. To volcanic phenomena of this nature the Spaniards give the name of *malpays*. That of Jorullo has an elevation of nearly 40 feet above the plain properly so called, and is convex, rising in the centre to a height which Humboldt set down as about 535 feet.

The mountain—that is to say, the cone of the volcano—was climbed in the short space of three-quarters of an hour. The crater is about $1\frac{1}{2}$ miles in circumference, and 650 to 660 feet deep. Its floor is covered with an accumulation of lava blocks ; numerous *fumaroles* burst forth from the side-walls ; and, owing to continual subsidences, the configuration of the interior is always changing. *M. Leclercq* descended into the crater and took the temperature in one of the chasms at the bottom. The thermometer registered 152° Fahr. The summit of the mountain offers a magnificent view of the surrounding country. Overlooking the valley or *playa* of Jorullo, which has been largely invaded by the lava, the volcano is in its turn dominated on the north by the massive range called the *Organos* ; on the west lies the grand peak of *Tancitaro* ; and at a distance of 120 miles one can discern the snowy summit of *Colima*, an active volcano, 12,685 feet high, situated on the border-line of the provinces of *Colima* and *Jalisco*, and not many miles distant from the Pacific Ocean.

Dr. Karl von den Steinen, his brother, **Wilhelm von den Steinen**, **Dr. F. Vogel**, of *Uelfeldt*, and **Dr. Ehrenreich**, of *Berlin*, have left for South America, in order to continue the explorations, and carry on the ethnographic studies, commenced by the brothers *Von den Steinen* in Central Brazil. The first-named took part, as doctor and naturalist, in the German Expedition to South Georgia, and in 1884, along with **Dr. Clauss** and his brother, carried out the exploration of the *Xingu River* in Central Brazil. **Dr. Vogel** also took part in the South Georgian Expedition, filling the post of *pro tem.* head of the meteorological station. **Dr. Ehrenreich**, in 1884, undertook an independent journey from Central Brazil northwards towards the Amazon.

AUSTRALASIA.

New Guinea : Huon Gulf.—The German Governor of *Kaiser Wilhelms Land*, **Freiherr von Schleinitz**, is taking an active share in the exploration of the unknown country committed to his charge. During the month of October 1886, he visited, with the German warship *Samoa*, the shores of *Huon Gulf*, in the north-east of New Guinea. The chief objects of the voyage were to examine the coast south of *Parsee Point*, with the view to the discovery of a harbour whence an entrance could be made into the interior ; to explore *Markham River* more fully ; and to get an idea of the general outline of *Huon Gulf* and its shores. The principal results of the voyage were the discovery of several useful harbours, and the mouths of some considerable rivers.

South of *Finsch Harbour*, and between *Langemak Bay* and *Huon Gulf*, lie the *Gingala Islands*, an archipelago consisting of six larger and two smaller islands. They run parallel to the mainland, with which they are connected by reefs, and are separated into two groups by a projecting headland, called *Naba-bangedu* by the natives. Between these islands and the mainland there is room for two harbours, which were named—*Schneider Harbour*, on the north, and *Dreger Harbour*, on the south. The entrance to each is on the south ; that of the former being but 3 fathoms deep, and only wide enough for small vessels,

whilst that of the latter will admit ships of any burthen, even sailing-ships. Dreger Harbour is land-locked, except for a distance of about 380 yards on the north; this, however, is fenced off from the ocean by a reef. The water within the harbour is from 12 to 20 fathoms deep. The adjoining coast consists apparently of coralline limestone, and is low and flat, with a very gentle rise towards the plateau-like range of Lugaueng in the interior. The next point along the coast at which observations were made was in the north-western corner of the gulf, a little to the east of Markham River, where the embouchure of a stream about 220 yards wide was examined. Across its mouth ran a bar of stones and detritus, rising 6 to 9 feet above the water, and having a rift 20 to 30 feet wide, through which the river forced its way in a violent current of a greenish colour. At a distance of 65 to 75 yards from the bar there were 10 to 13 fathoms of water. The natural breakwater that bars the entrance to Markham River, which was next visited, leaves room on the north for the passage of large ships, for, by hugging the shore at that point, the *Samoa* advanced to within a furlong of the river mouth, and cast anchor there in 14 fathoms. In this corner of the gulf the shore is so steeply inclined that the anchor, although cast in 15 fathoms of water, repeatedly refused to hold, rolling at once into much greater depths, or else remaining suspended. Markham River has a powerful current, from 220 to 500 yards wide, and is studded with numerous large islands; its depth is, however, not greater than 5 to 8 feet. Governor von Schleinitz is of opinion that it will prove to be navigable by small river-steamers. About 1000 yards south of the mouth of Markham River a second river was discovered. It winds through mangrove thickets, in a current 110 to 160 yards wide, but only 1 to 2 fathoms deep. Just before reaching the sea, it divides into two arms, the main branch apparently running parallel to the coast. The natural breakwater already mentioned protects the outlets of both rivers against the prevailing south-east wind, and so forms a secure, though deep, anchorage between itself and the shore. This harbour was named Prussian Roadstead.

Between Markham River and Parsee Point (a peninsula cut by 7° S. lat.), the coast consists of several ranges of mountains, rising one behind another, and varying in height from 1000 to 2300 feet. They are rugged in appearance, have abrupt declivities next the sea, and leave only a narrow fringe of low land between their foot and the water. The offset ranges start off mostly at right angles to the main chains, and frequently terminate in precipitous headlands. Between these secondary chains lie narrow trough-like valleys, traversed by small water-courses. The principal range of the system, to which the name Duke (Herzog) Mountains was given, has a N.N.W. trend. Here and there curiously-shaped ridges, with rib-like flutings down their sides, stand out from the main chain. Along this coast good anchorage is found in 15 to 25 fathoms of water at from one to two cables' lengths from the shore. Behind Parsee Point, which was once an island, and runs out from the mainland in a northerly direction, another good harbour was discovered, to which the name *Samoa* Harbour was given. It has everywhere 2 fathoms of water, and is securely protected against all winds. On the other side of this peninsula lies Bavaria Bay. In its south-west corner occurs the outlet of Francisca River, a stream about 160 yards wide. Its mouth is, however, silted up, and has only about 2 feet of water over the bar; above the bar the depth increases to 4 or 5 feet.

South of Parsee Point the mountains assume a different character. The ridges are less sharp, and several dome-shaped summits occur. The subsidiary chains are short, and, instead of projecting at right angles from the main range, lie in *échelon* almost parallel to the coast. Their axes also have a some-

what south-easterly trend, whereas those of the secondary chains further north trend towards the north-east. The valleys, too, along this part of the coast are different, being either broad and low, or else running obliquely in a north-west direction into the mountains. Several islands lie off the shore, viz., Dot, Solitary, Dampling, Longuerue, Boyen, and Stragging Islands. The coast-line is irregular, headlands and bays alternating very quickly. Opposite Longuerue Island lie Baden and Württemberg Bays, separated by Cape Göben. Each of these is almost entirely land-locked, and the water is smooth as glass. All the hills in the background are heavily timbered. Next comes Brunswick Harbour, the southern end of which resembles a huge crater-shaped caldron from 1000 to 1500 yards in diameter, and with 14 fathoms of water. South of Parsee Point the embouchures of three rivers are observed. The first, Nassau River, is an unimportant stream, 30 yards wide and 2 feet deep; somewhat higher up its width diminishes to 20 or 22 feet, while its depth increases to nearly 8 feet. Opposite Dampling Island is the mouth of Stein River, which is from $1\frac{1}{2}$ to 1 fathom deep, and has a breadth of 220 yards; this, however, soon diminishes by one-half higher up the stream. Its bed is broad and thickly strewn with stones, and the current, which occupies a winding channel 20 to 50 yards wide along the bottom, is very strong and rapid. The valley, along which this river flows, might probably be useful as a route for penetrating into the interior. The third river, called Margot, has its sea outlet south of Death Adder Bay, round a projecting spit of alluvial soil. Its mouth is about 220 yards broad, but is unfortunately closed by a line of breakers. Inside this barrier there exists an anchorage, with 14 fathoms of water. The river varies in depth from $1\frac{1}{2}$ to 3 fathoms, so that it would suffice for river-steamers.

Several native villages were observed scattered at intervals along the coast from Markham River southwards, and many well-trodden paths led through the woods apparently to settlements in the interior. The people were shy, and difficult of access. Their language differs from those (Jabim, Saleng, Tami) which prevail further north, having many gutturals, and some curious purring and clicking sounds. In dress and ornaments they are ruder than their fellows who live in the neighbourhood of Finsch Harbour, but they are more skilful in fibre-plaiting; in habits and customs they closely resemble the latter. The dwellers on the shores of Huon Gulf are cannibals, and stand at a very low level of intelligence.—*Nachrichten über Kaiser-Wilhelms-Land*, 1887, Heft 1 (with useful maps).

[In connection with this we may mention that the February issue of the *Royal Geographical Society's Proceedings* contains a Paper, by the Rev. J. Chalmers, on a coasting journey he made in 1878 along the south-eastern shores of British New Guinea, from China Straits westwards to Namau, the district of a race of cannibals.]

GENERAL.

Statistics of Earthquakes between 1865-1885.—The October issue of the *Sitzungsberichte* of the Vienna Academy of Sciences, consists mainly of a list of the earthquakes known to have occurred between 1865 and 1885. This has been compiled by D. C. W. Fuchs, and must have involved a great amount of labour, as it occupies 406 closely printed pages. In a brief survey of the more important earthquakes (nearly 8000 are registered), he includes, four in South America—(1) The Peruvian earthquake of 1868, which destroyed more than 100,000 human lives; (2) that of New Granada, in 1875; (3 and 4) those of Peru, in May 1877 and January and February 1878: three in Central America—(1) St. Thomas,

1867 ; (2) Guadalaxara, 1875 ; (3) Cuba, 1880 : two in North America—(1) California, 1865 ; (2) California, 1868 : six in Asia—(1) Bengal, 1869 ; (2) Onlah, 1869 ; (3) Bathang, 1870 ; (4) Antiochia, 1872 ; (5) Java, 1867 ; (6) Luzon, 1880 : and seven in Europe—(1) Cephalonia, 1867 ; (2) Cosenza, 1870 ; (3) Clana, 1870 ; (4) Belluno, 1873 ; (5) Agram, 1880 ; (6) Chios, 1881 ; and (7) Andalusia, 1884. After this survey follows an interesting series of Seismical Periods arranged geographically. These Periods may occur in regions where earthquakes are rare, as well as in those where they are frequent, and, after remaining undisturbed for many decades, a district may suddenly be convulsed by the most violent shocks. The most important Seismical Periods are as follows :—

Lake Baikal.—First period, from January to June, 1865. Second period (after an interval of some years), from September 3d to September 30th, 1883.

Capitanata.—In August 1864 an earthquake period began which continued almost without interruption for seven months. During this time scarcely a day passed without one or more shocks.

San Francisco, California.—An earthquake period began on February 7th, 1865. Between that date and October 6th numerous shocks occurred, culminating in the great Californian earthquake of October 6th to 8th. Frequent shocks continued up to the end of 1866, and a few were felt even in 1867.

Ionian Isles.—Commencement of the period, January 1865. From January to March 1866 the shocks became more occasional, but afterwards gradually increased, and culminated in a frightful earthquake in Cephalonia on February 4th, 1867. The period continued, and was marked by a second great earthquake on September 19th and 20th, after which frequent shocks occurred up till April 1868. The period was finally brought to a close in 1869.

Trinidad.—A great earthquake occurred on November 22d, 1865 ; was followed by numerous lesser shocks, and by a second great earthquake on November 26th. Frequent shocks continued till January 24th, 1866, and occasional shocks till the end of May.

Porto Rico and St. Thomas.—The period began at Porto Rico on October 19th, at St. Thomas a short time later. A great earthquake occurred on November 17th, 238 shocks being counted on the 19th alone. Shocks continued with unusual frequency till March 1868.

Lake Garda.—Period began on May 2d, 1866. Shocks were particularly severe on July 15th, and for three weeks following, over a hundred shocks being felt on the night of August 11th ; climax of the period occurred between December 2d and 5th. Total number of shocks, a thousand. A pause took place during 1867, but earthquakes again began in January 1868, and continued for several months, the most violent shocks occurring on February 20th. The Lake Garda region was further visited by earthquakes between May and December 1876.

Serrata, in the Azores.—Commencement of period, December 24th, 1866 ; shocks continually increasing till June 1st, 1867 ; from May 21st to June 1st, the ground in a state of constant agitation ; on June 1st, eruption at Terceira. Period continued some time longer ; concluded August 18th.

Gunung Sitolia.—Period lasted from May 14th to December 24th, 1868, and was marked by numerous shocks.

Hawaii.—From March 27th to April 6th, 1868, over 2000 shocks occurred. The period continued, but with less violence, till November 1871.

Sierra Nevada (N. America).—Period commenced August 1868 ; a great earthquake occurred on 4th September, between which date and the 6th 500 shocks were felt. The period continued till September 28th.

Peru.—Commencement of the period, January 10th, 1868. Frightful earthquakes in Tacna and Arica on 13th, 16th, and 19th August; frequent shocks for ten days; in Tacna, 250 shocks between August 15th and 21st; shocks continued at intervals till the end of the year.

Dalmatia.—Commencement of the period, 9th October 1868; climax, May 1869; continuance of shocks till July.

Jaszbereny.—Commencement of period, June 21st, 1868; shocks most intense on 20th and 21st August; gradual subsidence till September 17th, 1868; after a long pause, fresh shocks on September 8th, 1869, and continuance at short intervals for several weeks.

Rumania.—Commencement of period, November 13th, 1868; frequent shocks till November 27th; and again from January to May 25th, 1869.

Grossgerau.—Frequent shocks from January 13th to 20th, 1869; after a considerable interval, renewed disturbances on October 18th. Between that date and the close of the year many hundred shocks occurred, and were continued at short intervals throughout 1870. Slight earthquakes were felt in this region for some years longer, nine being registered in 1874.

Schemacha.—First shock, August 21st, 1869; frequent shocks after September 21; great earthquake on December 6th; from March till May 1870 frequent shocks, and again from January 16th, 1872, onwards; on January 17th and 28th, severe earthquakes; end of the period in middle of July.

Calabria.—Frequent shocks from January 30th, 1869; most numerous in November and December, particularly between November 28th and December 4th; gradual cessation till close of the year.

Istria.—Period commenced, February 27th, 1870; on 11th May, between 3 and 5 P.M., scarcely five minutes passed without a shock; slight shocks were also felt in 1871.

Yokohama.—Occasional shocks from January 1869 to April 21st, 1870; from May 1st, 1870, shocks more frequent, 123 occurring between May 1st and 15th; after May 22d, shocks less frequent. Renewal of disturbances at intervals from 19th February 1873 to February 1878.

Antilles.—Period from June 8th to July 1st, 1870.

Cosenza.—Great earthquake on October 4th, 1870; frequent shocks between 4th and 8th, and even until December 3d; then a pause until December 10th, and again until June 1871.

Nassenfuss.—From November 2d till December 18th daily shocks; the maximum being reached on December 3d.

Belluno.—Great earthquake on June 29th, 1873; numerous shocks of ever-increasing violence throughout July, and on August 8th, and December 25th; in 1874, occasional slight shocks.

Bagnères de Bigorre.—Single shocks on January 16th, in the middle of August, and on October 28th, 1873; and frequent shocks from 26th to 29th November.

Lower Rhine.—Severe earthquake on 19th October, 1873, followed by frequent shocks up till November 12th; in 1874 repeated earthquakes, particularly on August 28th and September 5th; after a long interval, frequent shocks between August 26th, 1878, and April 9th, 1879.

Romagna.—Frequent shocks between September 1874 and May 1875; 80 occurring between 20th and 28th January 1875 alone.

Corleone.—On April 22d, 1876, a severe earthquake, accompanied by a loud noise, occurred in Corleone, between Girgenti and Palermo. On June 7th the shocks were less local, and on the 7th and 10th were of such violence that the

cathedral in Corleone was laid in ruins. Shocks of a less severe character continued to be felt occasionally till December, when they became very frequent. Not until the middle of April 1877 did the shocks entirely cease.

Lower Danube.—Period lasted from 10th to 26th October 1879, the shocks being almost uninterrupted from the 11th to the 14th.

Cuba.—Period lasted from January 22d to August 20th, 1880, the shocks being most marked after January 25th.

Agram.—An earthquake of unusual extent and severity took place at Agram on November 9th, 1880, and was followed by a period marked by numerous shocks, of which the most violent were those of the 11th and 16th December. Occasional shocks were also felt in 1881.

Andalusia.—Period lasted from December 25th, 1884, to March 1885. A violent earthquake took place on December 25th, and was followed by several severe shocks, of which the most intense were those of the 27th, 30th, and 31st December 1884; the 5th, 7th, and 27th January; and the 2nd and 21st February 1885.

Methods for Determining the Height of the Snow-Line.—It is easier to give a definition of the snow-line than to fix it definitively in nature. Theoretically, it is sufficient to say that the snow-line is that *isohypse* (line of height) along which during the course of the year just as much snow falls as the sun's warmth during the same period is able to melt. The first deduction from this definition is one which fact corroborates: the snow-line is not by any means a precise immovable line, but rather one which varies both in space and time—in space, moving its position up and down the sides of mountains according to their situation with respect to the points of the compass; in time, varying from year to year in accordance with the meteorological vicissitudes of the place. It would in fact be more correct to speak of a zone or belt, bounded by inferior and superior limits, within which the average snow-line altitude is wont to fall. In attempting to fix the limits of such a zone, the scientific geographer must take into account, not what Rätzel calls the orographical snow-line, i.e. the snow-line which depends upon masses of snow gathered in gorges and ravines impenetrable to the sun, but the climatic snow-line. To fix the snow-line by this method actual observation alone is relied upon; that is to say, numerous series of practical observations are taken, extending over several years and made at a sufficient number of places, as to the precise altitude to which the *continuous* snow-line had descended before the first fall of permanently abiding snow in autumn. This is the common method of determination. But two other methods have been elaborated and put to the test of practical experience.

The first depends upon the orographical situation of glaciers and their areas. It may be assumed that whenever glaciers hang freely on the sides of mountains—those that fill up ravines and places inaccessible to the sun's rays are not here considered—part of their areas stretches above the permanent snow-line. Consequently the snow-line lies at a less altitude than the mountain summits which surround the glaciers. Thus we get a superior limit for the determination of the snow-line. On the other hand, there are mountain peaks situated at a less altitude than the glaciers, and destitute of snow; hence we are able to fix the inferior limit. These limits being determined, all that then remains to be done is to trace out the distribution zones of the glaciers, and the snow-line can be obtained with approximate accuracy. This method was first used by Simony, later by Partsch, Penck, and Brückner.

The last method we have to sketch has been employed by the last-named for the determination of the snow-line on the Hohen Tauern. Every glacier consists of two parts—one situated above the limits of snow, the "collecting region," and the other below the snow, the "ice stream." The proportional relation between the areas of the two parts is extremely variable. But in all cases the surface of the ice stream is less than that of the collecting region. The relation depends upon the size of the glacier; for under precisely similar circumstances a more extensive glacier, as a consequence of its greater velocity, requires an ablation (melting) surface not only absolutely but also relatively greater, if equilibrium is to be maintained between augmentation and subduction of the glacier itself. Edward Richter gives 8:1 as the normal proportion. Dr. Brückner estimates that at least one-fourth of a glacier's area lies above the limits of perpetual snow, and at most not more than three-fourths below. By finding what isohypsal surface is equivalent in area to the part situated above the snow-line, we get the corresponding isohypse as the maximum altitude of the latter. This gives, be it noted, the maximum indication, because, in the first place, the proportion 3:1 is certainly too great, and in the next place those steep walls and declivities, occurring above the limits of snow, which are free from snow are not reckoned as belonging to the glacial areas.

By this method, Dr. Brückner has determined the height of the snow-line in different parts of the Hohen Tauern. Taking the known areas of glacial surface, and the isohypsal surfaces of the altitudes 2700 mètres (8859 feet) and 3000 mètres (9843 feet), as measured by a Polar planimeter on the map of the Austrian General Staff (scale 1:75,000), he obtained the following results:—

Region.	Proportion. 3:1		Proportion. 8:1	
1. North side of the Venetian group,	2750	} 2750 mètres.	} 2700 mètres.	
2. " " Glockner "	2800			
3. " " Rauris Tauern,	2700			
4. " " Ankogel group,	2750			
5. South side of the Venetian group,	2900	} 2850 "	} 2800 "	
6. " " Glockner "	2850			
7. " " Rauris Tauern,	2900			
8. " " Ankogel group,	2825			
9. Rieserfern group,	2850	} 2900 "	} 2900 "	
10. Schober "	2950			
11. Virgen Mountains,	2950			

The last two columns give the altitude of the snow-line on the basis of 3:1 and 8:1 as the proportions respectively between collecting region and ablation surface (or ice stream). The very slight difference in the results obtained from the two proportions is explained by the fact that in this region a small increase in height involves an appreciably large diminution in surface. The general conclusion to be obtained from the above calculations is this: In the Hohen Tauern the snow-line rises from north to south, ranging at 2750 mètres (9000 feet) on the north side, and at 2850 mètres (12,300 feet) on the south side, and ascends still higher on those parts of the chain which project further to the south, viz., to 2900 mètres (12,500 feet).—Dr. Edward Brückner, in *Meteorologische Zeitschrift*, January, 1887.

Periodical Vacillation of the Atmosphere.—In the *Meteorologische Zeitschrift* for January 1887 there is an interesting paper on the periodical vacillation of

the atmosphere between the two hemispheres of the earth. The writer says that a high atmospheric pressure travels periodically from one hemisphere to the other. It is to be found in winter in the northern hemisphere, and in our summer in the southern. There is also a yearly exchange of great atmospheric masses between the two hemispheres, which is accounted for by the unequal distribution of land and water. The results which he has obtained are as follows:—that there is a constant difference of average atmospheric pressure of 2·22 mm., and that it is possible to calculate the periodical exchange which takes place between the two hemispheres. For instance, the difference in the height of the barometer between January and July in both hemispheres is 2·98 mm., so that the amount of the atmosphere which is exchanged is equal to a mass of quicksilver 2·98 mm. thick, covering the whole of the surface of the earth, and periodically flowing from one hemisphere to the other. This layer of quicksilver is equal to a layer of water of 2·29, 13·6=40·5 mm., and the total mass is 101 million tons. There is also 202 million tons less air in July in the northern hemisphere than there is in January.

Lengths of Rivers.—According to C. A. von Klöden, the seven longest rivers of the world, each more than 2800 miles long, are the following:—

1. Nile,	4018 miles.	5. Jenisei, with Selenga,	2950 miles.
2. Missouri-Mississippi,	3653 „	6. Congo,	2881 „
3. Yang-tse-kiang,	3156 „	7. Mackenzie,	2866 „
4. Amazons,	3061 „		

The Russian Dr. Alex. von Tillo gives a list of eight rivers each longer than 2800 miles. His list, which differs somewhat in detail from Von Klöden's, is as follows:—

1. Missouri-Mississippi,	4192 miles.	5. Jenisei, with Selenga,	2950 miles.
2. Nile,	4018 „	6. Amur,	2919 „
3. Yang-tse-kiang,	3156 „	7. Congo,	2881 „
4. Amazons,	3061 „	8. Mackenzie,	2866 „

MISCELLANEOUS.

Pallu de Lessert is exploring **Tunis and Algiers**, in order to discover remnants of the Roman occupation.

An unfavourable decision has been arrived at, in regard to the **Proposed Tunnel between Denmark and Sweden**, by the delegates appointed to consider its feasibility.

Earthquake Shocks, causing loss of life and damage to property, were experienced during February on the Mediterranean seaboard of France and in the Riviera.

In the *Meteorologische Zeitschrift* for January 1887, there is an interesting contribution to the climatology of the **Canary Islands** by Dr. Biermann, which will be of special interest to physicians proposing to send patients to spend the winter there.

The Mathematical-Mechanical Institute of A. Ott in Kempten has constructed a **Curve-measurer** for the measurement of river-courses on maps. A pencil is made to follow the minutest bendings and the sharpest angles of a river, so that, in future, if the instrument prove to be satisfactory in use, greater accuracy ought to be obtained in estimating the lengths of rivers from their delineations on maps.

According to a *Times* telegram from the Governor of Natal, dated Durban, February 20, "The supreme authority of the Queen has, with the approval of Her Majesty's Government, and the acquiescence of the chiefs and people of Zululand, been extended over **Eastern Zululand**." We also understand that the annexation of the New Republic (**Western Zululand**) to the Transvaal has been practically arranged, and will be carried into effect after the Republic has been formally acknowledged.

NEW BOOKS.

Gazetteer of the British Isles, Statistical and Topographical. Edited by JOHN BARTHOLOMEW, F.R.G.S. With Appendices and Special Maps and Charts. Edinburgh: Adam and Charles Black, 1887. Price, 36s., half-morocco.

Mr. Bartholomew's *Gazetteer of the British Isles* is a book with a very prepossessing appearance, as such books ought to be. It is both substantial and handsome externally. It is printed in clear bold type, on excellent paper, and it is furnished, as might have been expected, with a number of beautifully executed and tastefully coloured maps. The feeling it produces at first sight is that of a book that is designed to stand a great deal of use, and that will always be pleasant to handle. But the handsomest book of reference will not be much used if it is not found to be really useful. Judged by this test, Bartholomew's *Gazetteer* will evidently be required to stand a very large amount of tear-and-wear. We make no doubt that it will answer all the demands made on it fully and satisfactorily—fully, in the sense of adequately, rather than in that of copiously—for it is a gazetteer, not an encyclopædia,—and satisfactorily, in the sense of giving a large amount of accurate information in a condensed and handy form. In one respect the fulness is remarkable—namely, in respect of the number of articles or of places described. We have not attempted to count the separate entries, but we have estimated them roughly at a minimum of sixty thousand. They include not only the ordinary civil and ecclesiastical districts, physical features, cities, boroughs, and villages, but also small hamlets, mansion-houses, railway stations, and lighthouses, as well as localities and objects which are interesting to the historian, the tourist, and the antiquary. The essential point, however, is, that the information given about each place is at once trustworthy, and of a kind that will satisfy those who consult the pages of the work. As to trustworthiness, we do not, of course, profess to have read every article in the book; but we have tested it at many points, with the result that we have failed to discover any serious error, or any statement to which objection may be taken. Then as to the kind of information, we find, in addition to the ordinary topographical and statistical facts and figures, a great many items not usually given in works of the same kind. For example, in the case of every town, the inquirer is furnished with information regarding its means of communication by road and rail, by river and canal, and by coasting steamboat, as well as by post and telegraph—regarding its banks and churches, its newspapers and its market days. These features cannot fail to make the work very valuable to commercial men, to members of Parliament, to journalists, and to travellers of every class. The maps, which are twenty-three in number, and which have been specially prepared for the work, enhance the value of these features. The physical maps appeal to the geographer and the geologist; the vital and industrial maps to the sociologist, the manufacturer, the merchant, and the agriculturist; the Parliamentary maps to the politician; the railway maps to the traveller; and the

general maps to all classes. The work is highly creditable to Scottish enterprise and skill, and there can be little doubt that it will at once attain its deserved position as a standard book of reference.

Travels with the Afghan Boundary Commission. By Lieutenant A. C. YATE, Bombay Staff Corps. With Maps and Illustrations. Edinburgh : William Blackwood and Sons, 1887.

This is the first volume on the delimitation of the northern boundary of Afghanistan and the southern boundary of Russia in that part of Central Asia ; yet it might have been much better. Those who read the Allahabad *Pioneer* and London *Daily Telegraph*, at the time, are familiar with its pages. The author must not be confounded with Captain C. E. Yate, who did good service all through the long and trying expedition, especially at Panjdeh. Until the India and Foreign Offices allow the political and survey officers to open their mouths in public, we must be grateful for this collection of old letters. We trust Sir West Ridgeway will address the Scottish Geographical Society on the subject even this session. The survey reports of Major Holdich, Captains Gore and Peacocke, and Hon. M. G. Talbot should soon see the light. Mr. Merk, one of the able young officers of the Panjab Commission, saw and did as much as any member of the party ; and we hope Sir Charles Aitchison will publish his report before it has ceased to have a living interest. Until these appear we are thankful for the map which Lieutenant Yate has given us on the scale of 1 inch to 32 miles, showing the march of the Indian section of the Boundary Commission from Quetta to Herat and Badkhis, the frontier as proposed and actually demarcated, and the author's return journey from Herat to the Caspian. Indeed, the immediate benefit of this, as yet, incomplete attempt to fix an international boundary east to the Upper Oxus and Pamir, is almost entirely geographical. We agree with a local critic, who thus summarises the survey and military results :—

“ The surveys, conducted within a very wide radius of the line of march, some of them constituting almost independent enterprises, have yielded results which to the Intelligence Department of the Indian Army must be invaluable, and which certainly will be helpful to us if any time we enter upon the bold venture of endeavouring to defend our frontier from beyond its limits. Thanks to the Mission, the new map of Afghanistan will more closely represent geographical facts than it has done hitherto, and route-marches may be marked out with an accuracy of estimate in regard to water, supplies, and indispensable matters of that kind, which has been until now unattainable. From the Helmund to Ghorian the Mission traversed a country which had rarely, and in some places never, been visited by any European traveller, and of course had never been scientifically surveyed. One result of the Mission, therefore, has been an important rectification of the maps of the Helmund and the surrounding districts. But a still greater result, and one that should be duly appreciated in the Quarter-master General's Department, is that the survey officers of the Mission have opened up a military route, passable for all arms, from Kwaja Ali to Herat, by which the flank of a Russian army advance on a line due eastward to Kandahar, by way of Farah, could be easily operated upon.” Lieutenant Yate says a good deal about the disaffection of the Turkoman and Usbeg tribes, as well as makes candid acknowledgment of the result of Russian rule in quieting and ameliorating the condition of these people. ‘ We now know,’ he says, ‘ that we have another weapon at our command, and that is the seditious spirit prevalent throughout the Russian possessions in Central Asia.’

The Cruise of the Marchesa to Kamschatka and New Guinea; with Notices of Formosa, Liukiu, and various Islands of the Malay Archipelago. By F. H. H. GUILLEMARD, M.A., M.D. (Cantab.) With Maps and numerous Illustrations. 2 Vols. London: John Murray.

The era of maritime discovery and exploration, except with regard to Arctic and Antarctic Seas, is popularly supposed to have gone out before the era of steam yachts came in. The *Cruise of the Marchesa* proves that this is only a popular error. The fortunate voyagers on board the *Marchesa*, on her long cruise in Pacific waters, were able to enjoy, in addition to the ordinary pleasures of yachting in tropical, temperate, and sub-Arctic seas, the excitements of the sportsman, and the deeper and more lasting delights of the naturalist and collector, and also some of the glory of first-hand exploration. Dr. Guillemard's fascinating record of the trip is evidence of the excellent service which a craft so manned and equipped can do for geography and the cognate sciences, by a voyage to the eastern coasts of Asia and the neighbouring islands. A few notes from the *Marchesa's* log will show how much ground she was able to cover in a short period of time, and may give an idea of the admirable work that awaits in this field the volunteers of science who are so fortunate as to obtain the control of a steam-yacht. In April 1882 the *Marchesa* reached Colombo, on her way to Chinese waters. Within two years she had returned to Southampton. In the interval she had steamed along the eastern coast of Formosa, and landed under the cliffs, 5000 feet in height, a party who made an excursion into the unknown interior of this portion of the island. She passed some time at the Liukiu (Loo-choo) Islands, which, with their interesting race and civilisation, have strangely escaped the notice of voyagers—or at least of the voyagers who write books—since Captain Basil Hall's time. She lay for some time in Avatcha Bay, while Dr. Guillemard, Lieutenant Powell, and others made an expedition inland to the upper waters of the Kamschatka River, and followed that stream to its mouth, collecting by the way great store of ethnological facts, and zoological and botanical notes, making a rough survey of the course of the stream, and the area and position of the great mass of volcanic mountains grouped around Klutchefskaya, and noting and naming two fine peaks of 8000 or 9000 feet in height—Mount Gordon and Mount Herbert Stewart—not hitherto mentioned in the maps. After visits to Behring's Island and other members of the "Fur Seal" group, to the Japanese coast, and to the Chinese treaty ports, the *Marchesa* began a prolonged and most interesting cruise among the islands of the Malay Archipelago, in the course of which the Sulu group, Borneo, Sumbawa, Celebes, the Moluccas, New Guinea, and the Banda and Aru Islands were visited in succession, and valuable additions were made to our knowledge of the natural history, geography, and ethnology of the regions. Of the more purely geographical work, perhaps the most important was that done in the volcanic region of the Kamschatka River. In addition to clearing up various doubtful points, and rectifying errors, and filling up details in the previous existing maps, the *Marchesa* party had opportunities, which they did not fail to take advantage of, for ascertaining, under favourable conditions, the heights of the principal crater peaks of the Klutchefskaya group. The altitude of the four chief volcanoes, lying to the south of the lower part of the Kamschatka River, are given as follows:—Klutchefskaya, 16,988 feet; Uskovska, 12,508; Koejerska, 15,400; and Tobatchinska, 11,700. Mount Gordon and Mount Herbert Stewart, the two volcanic cones lying to the south-east, and named for the first time by the party, were not approached closely; but the height of both of

them is "probably about 8000 feet." One or two minor discoveries of some interest were made by the *Marchesa's* crew at Cagayan Sulu, a detached island, lying nearly due north of Sandakan, and connected with Borneo rather than with the Sulu group. It is described by Dr. Guillemard as the most captivating of all the tropical islands he had seen: "As the boat glided over the coral-gardens, bright with vividly coloured fish, and landed me, gun and collecting-box in hand, on the mossy land, I felt as if I could cast off civilisation and European clothes alike, and cultivate my mealie patch and grove of cocoanuts with the natives for the remainder of my natural life." One of the objects of landing was to explore the curious crater-lakes, communicating with the sea on the south side of the island; and the party met with success beyond their expectations in the discovery of a third perfectly circular crater basin filled with water, not mentioned by Admiral Keppel, or included in the survey of H.M.S. *Nassau* in 1871. Still another unexpected "find" was made, in a lagoon, on the north coast, entered through a narrow boat channel, and opening up into "as good a harbour as could be desired during the south-west monsoon, well protected to the east and west by reefs, and having an average depth of 15 fathoms, with a sandy bottom." Dr. Guillemard emphasises the broad zoological characteristics distinguishing Borneo from the Philippine group and the Sulu Archipelago, the limits of the Indo-Malayan and insular region being marked by the deep-water channel of the Sibutu Passage, off the north-east end of Borneo. The contrasts in flora and fauna are as marked on either side of this strait of 18 miles in width as in the parallel case, so frequently alluded to, of Bali and Lombok. We are unable to follow Dr. Guillemard through his fascinating cruising afloat and wanderings ashore in the other islands of Malaysia. Special attention was directed to the avifauna, and the author was very successful in obtaining examples, living as well as dead, of various species of the Bird of Paradise, a tribe which he is insistent in pointing out is entirely confined to Papua and the Papuan islands, with the exception of a single species found on Gilolo, though a popular lady-traveller has extended their range to the Malay Peninsula. Of four smaller Birds of Paradise captured, three were successfully brought to England; a specimen of the magnificent Twelve-wired Bird of Paradise unfortunately died before the yacht got beyond the tropic. Concerning its habits on board Dr. Guillemard writes:—

"He had got tame very quickly, and would readily eat from our hands. By day he usually remained more or less quiet, and was fond of resting motionless, with the head sunk low on the chest; but in the morning and evening he moved restlessly from perch to perch with a peculiar bounding hop. His manner of feeding was wonderfully neat. Any cockroach that ventured into his cage he would catch with lightning rapidity, seizing it across the body with his long sharp beak. Then, giving it a sudden snap, he would throw it in the air and catch it lengthways, displaying the vivid grass-green colouring of his mouth and throat in the operation. The only note he ever uttered was a single unmelodious croak. The least fall in temperature seemed to be felt by this beautiful creature."

As to the nesting habits of the Bird of Paradise family, Dr. Guillemard failed, in spite of offering large rewards, to collect any definite information; they remain as much unknown as when Peter Heylyn wrote in his *Cosmography*, that "it is said, there is a hole in the back of the cock in which the hen doth lay her eggs, and hatch her young ones;" and the same advice applies—"I bid no man believe these relations." Among the curious notes made is the statement that the eruption at Krakatoa was heard, like the "sound of distant cannonad-

ing" at the island of Dorei, as confirmed by the entries made by Mr. Van Hasselt in his diary on the day in question. Dorei is over 1700 miles from Krakatoa, and, as Dr. Guillemard says, "it seems incredible that explosions proceeding from Hecla could be audible at Rome, or that, if a volcano were suddenly to make its appearance in Timbuctoo, we might be conscious of the fact in England." The book, in addition to its other attractions, is beautifully illustrated, and contains fourteen maps.

Madeira and the Canary Islands. A Handbook for Tourists. By HAROLD LEE. Liverpool: Lee and Nightingale, 1887. Pp. 56. Price 6d.

This little handbook narrates very pleasantly a tour to Madeira and the Canary Islands, which are now so accessible. The peculiarity of these islands is the equability of their temperature. Warm days are not succeeded by chilly nights. The evening temperature varies but little from the shade temperature of the day. The climatic dangers of the Riviera and other fashionable resorts have thus no existence here. The mean noon monthly temperature of Grand Canary ranges from 63° in January to 82° in September. By way of comparison, we may add that the mean monthly temperature of Edinburgh ranges from 36° in January to 58° in July. The rainfall in the Canaries is about 14 inches in the year, whilst that of Madeira is 29 inches, or a little above that of Edinburgh. For eight months in the year (from April to October) the north-east trade-wind prevails in the Canaries, blowing in from the ocean, and having a delightfully cooling and freshening effect upon the atmosphere. South-west winds prevail during the other portion of the year (November to March), with occasional breezes from the south-east, which, having passed over the great African desert, are hot, dry, and disagreeable.

NEW MAPS.

(Edited by Professor James Geikie, LL.D., F.R.S.)

ASIA.

ASIEN.—Uebersichts-Karte der ethnographischen Verhältnisse von —, und von den angrenzenden Theilen Europas, von VINZENZ VON HAARDT, 1887. Massstab 1: 8,000,000. 6 Blatt.

Wien, Eduard Hölzel. Price in sheets, M. 30.

In this beautiful and elaborate map, Dr. Vinzenz von Haardt represents at one view the ethnographical features of Asia. The work, which, as the author tells us, has cost him many years' labour, may be regarded as a complete embodiment of our knowledge of this great and complex subject, down to the present time. In its compilation, Dr. Friedrich Müller's well known *Allgemeine Ethnographie* has been used as a basis, and all the other authorities and recent investigations have been carefully studied, while it has also undergone a thorough revision at the hands of many of the most experienced specialists in ethnography, and enjoyed the patronage of the Imperial Academy of Science in Vienna. Thus, it is to a certain extent beyond criticism, and it only remains for us to hope that such valuable work will be fully appreciated by all students of geography, by the statesman and politician, as well as by the man of science; for at the present day the complications of Eastern politics cannot be properly understood without the assistance of such a map as this.

The engraving and printing have been executed with the usual high standard of excellence which characterises all the publications of "Hölzel's Geographische Institut."

JAPAN, showing the Relations of Elevations and Depressions to the Lines of equal Magnetic Declination. Scale 1 : 5,702,400.

Proceedings of the Royal Geographical Society, February 1887.

This interesting map by Dr. Edmund Naumann is in illustration of his paper on the "Physical Geography of Japan."

AFRICA.

CONGO-STROMES, Karte des —, zwischen Kasonge und der Station der Stanley-Fälle. Originalaufnahme des Leiters der österreichischen Congo-Expedition, Professor Dr. Oscar Lenz. Massstab, 1 : 1,130,000.

Wien : Mitt. der Kais.-Königl. Geographischen Gesellschaft, Band xxix., No. 12.

This map shows, with greater detail than has yet been published, the course of the Upper Congo from Stanley Falls, on the Equator, to Kasonge, five degrees south.

SÜDAFRIKA. Die Portugiesische Expedition quer durch Südafrika, 1884 and 1885. Nach den Originalkarten von Capello und Ivens. Massstab, 1 : 1,000,000.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 3. Gotha : Justus Perthes.

This is a portion of Justus Perthes' new large map of Africa, showing the route of the Portuguese Expedition that was led across South Central Africa by Messrs. Capello and Ivens. Their explorations have resulted in many important alterations on the previous outline of the map, and many blank spaces have been filled up.

AUSTRALASIA.

PICTURESQUE ATLAS OF AUSTRALIA.—Edited by ANDREW GRATTAN, M.A. LL.D. Parts 1, 2, and 3.

Sydney and Melbourne : The Picturesque Atlas Publishing Co. Price 5s. each part.

The special feature of this work is in its very beautiful illustrations, which are produced in the finest style of wood engraving, and give most characteristic and striking representations of Australian scenery. The maps at present issued are merely general and introductory, and with no special features worthy of notice, but the whole work, when finished, promises to be very comprehensive.

NEW GUINEA, South-eastern part of —, illustrating the Explorations of the Rev. J. Chalmers, L.M.S. Scale 1 : 1,774,000.

Proceedings of the Royal Geographical Society, February 1887.

NEW GUINEA. Skizze der Nord-Ost-Ecke des Huon-Golfes (Kaiser-Wilhelms-Land) aufgenommen und gezeichnet von HAUPTMANN DREGER. Massstab, 1 : 50,000.

Berlin : Nachrichten über Kaiser-Wilhelms-Land und den Bismarck-Archipel. Heft. 1, 1887.

The above map is very satisfactory evidence of the progress the Germans are making in the exploration and mapping of their new territory.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

RAINFALL IN AUSTRALIA.

VALUE OF RAIN AND IRRIGATION.

BY J. T. WILLS.

RAINFALL statistics and maps are little heeded by the British public, as a rule, for want of a vivid appreciation of the extreme value, in dry countries, of every inch of rain.

I have, therefore, appended to the two maps of Australian rainfall, some facts and considerations from which, in a rough way, and under given climatic conditions, we may trace the limits of agriculture, and estimate the pecuniary value of rain and of irrigation water.

In South Australia there seems to be a close and direct relation between rainfall and wheat-yield, which is very interesting, and which does not appear to have been hitherto noticed or discussed.

The new and important departure now being taken in Victoria in state-controlled irrigation (which should be closely watched by investors and promoters of emigration in this country) gives a practical interest to the subject of water values; as do the vain efforts of New South Wales to plant agricultural settlers in districts where they cannot prosper, to the question of the limits of agricultural settlement.

The first map shows the annual rainfall in Australia. The South Australian records are the longest and most complete, but no returns later than 1882 are to be found in this country. The colony has had bad seasons since, and apparently wishes to conceal the fact by not publishing returns. Her agricultural statistics, too, have just been discontinued, because they were such melancholy reading. In the other colonies I had to use the tables of monthly and yearly rainfall for the ten several years 1871-1880 throughout Australia (in millimètres),

published by Raulin in the *Bulletin of the French Meteorological Society*, 1884, as Victoria sends no annual returns (that I can find) to London, but only monthly sheets, and New South Wales, though prodigal of annual, is most chary of monthly totals. In the interior slope, or Darling and Murray basin, in New South Wales and Queensland, the annual rainfall lines are copied from Mr Gipps'¹ rainfall map of that basin, which appears with his article on the irrigating capacity of the New South Wales rivers in the second number of the *Australasian Geographical Society's Journal* for 1886. His map is drawn from the averages of all observations made there up to the end of 1883. The course of his isopluviose lines evidently follows the contour lines, which are not to be found in any map in this country, but with which Mr. Gipps is familiar. The remaining lines in Queensland are taken from the Queensland rainfall map in the Colonial Exhibition, and represent the averages of only seven years, 1878-84. As for the previous returns,—these are scanty and of doubtful value.

In Victoria, in the Murray Basin, I have had to correct Mr. Gipps' lines. Not being concerned with the water supply there, he had drawn his lines less carefully.

On the coast slope in New South Wales, the averages are made up to the end of 1883. In Victoria (coast slope) and in West Australia they are only for 1871-80 (from Raulin). In Tasmania the rainfall shown is that of the one year 1885. I had hoped to get uniform and complete returns everywhere for fourteen years, 1871-84; but the colonial agencies simply do not keep, and do not supply other libraries with, the necessary data. The map is therefore provisional. The period 1871-80 alone would not have correctly represented the average climate. In East Australia generally, especially in New South Wales, that period was more rainy than the average. The drought that followed in 1881-85 was by no means unprecedented, and should be expected to occur again.

Annual rainfall is a fair *primâ facie* guide to the pastoral capacity of a country. Grass benefits by rain at any season (provided that enormous deluges do not come, as they often do in Australia, in a single day), and the more even the distribution is throughout the year the better. The cultivator, on the other hand, requires rain for about half the year, and is scarcely benefited by rain in the other half. This is especially true of grain crops and vineyards.

The second map is prepared, therefore, with reference to agriculture, and, especially as far north as Toowoomba, Queensland, with reference to the cultivation of wheat, which is the limit crop where rainfall is slight. Ten inches rainfall in the winter half of the year is about the limit of wheat culture, and of agriculture generally on fairly good average soils. Raulin's tables for the years 1871-80 have been taken, and the returns of the four years 1881-84 have been added wherever possible. North

¹ The Government Surveyor of New South Wales.

of Toowoomba these rains are insufficient for wheat or any other usual winter crop.

The wet season in Queensland is the summer. The limit of 20 inches of summer rains in the wettest six months is laid down for the same period, 1871-84. It probably marks the limit of maize culture.

The lines of 20, 25, 30 inches annual rainfall in the Darling basin, according to Mr. Gipps, and of 30 and 40 in Queensland (for the years 1878-84), the figures indicating the annual¹ rainfall of districts on the coast slope of New South Wales, are also shown on the map, these annual rainfall lines being dotted. The addition of subsequent returns would bring Mr. Gipps' lines a little nearer to the coast, and would reduce the Victorian averages. In South Australia, "Goyder's line" is marked. It was laid down as a guide and limit to farmers, and its correctness as an indication of the limit of profitable regular wheat culture has been pretty well demonstrated by sad experience. It nearly corresponds to the limit of 15 inches rain in the year, or of 10 in the winter half-year.² No ordinary map of Australia should fail, though all do, to mark it.

THE VALUE OF RAIN.—Land without rain is worth nothing, and land in an Australian climate with less than 10 inches a year is worth next to nothing. Rain-water without land, if it can be stored in a reservoir and sent along a canal, is worth a great deal. In Spain, for instance, flat, unirrigated, but irrigable land, in the plains of Valencia or Murcia (which are on the Mediterranean coast), and with soils of first-rate quality, is worth £20 an acre. These lands have an annual rainfall of some 18 inches, and can obtain irrigation water generally by paying for it. Uplands in Castile, with a rainfall of 10 inches a year, are hardly worth anything at all. But if I owned a canalised river and reservoir in Murcia (the Lorca reservoir, for instance, where water is sold every day by auction), I would rather have an extra square league of bare rock added to the area, whose rainfall filled my river (provided a full 10 inches of rainfall ran off the rock into the river annually), than two square leagues of this good bottom land worth £20 an acre, with its 18 inches of annual rainfall that sank in or evaporated where it fell. The rock would be worth more.

Moreover, in a climate like that of Australia, while land with 10 inches rainfall is almost valueless, land with 20 inches is not half so valuable as similar land with 30. Of course, in speaking colloquially, as I do here, of differences in "rainfall," the usual concomitant differences in humidity, rate of evaporation, and the like, are implied as well. I assume that the

¹ Average of all observations, up to the end of 1883. Stations in one district are grouped, and the mean rainfall of the group is taken. These figures appear on the map of rainfall appended to the New South Wales *Report* on the state of the Crown lands.

² The rains decrease with the elevation on both sides of the range of hills, and most rapidly on the north-east. See Trollope's *Australia* for "Goyder's line."

rainfall of the surrounding district is similarly raised, else its dry air and heat would parch the solitary favoured spot.

Compare first the increase of *pastoral* capacity with the increase of rainfall in the following wide areas.

1. South Australia has $6\frac{1}{2}$ million sheep, and 500,000 square miles leased for pasture, the average rate therefore is 13 sheep to the mile only;¹ deducting the sheep on the freehold lands, and the crown leaseholds intermixed with them (a deduction of less than 2 per cent. of the total area), it is only some 8 or 9 to the mile on the remainder, where the rainfall averages some 8 or 10 inches. A great part seems to be leased at half-a-crown a square mile, with compensation for improvements for fourteen years, or for twenty-eight years without compensation² at an increased rent. Of the unleased land in the interior of the colony, the great part is desert and valueless, as is also almost the whole of West Australia (and indeed of the United States and Central Asia) below the 10-inch line.

2. In New South Wales, the west half (55 per cent.) of the colony, west of the longitude of Forbes, and north and east of the Lachlan, carried in 1881 just 96 sheep to the square mile. The rainfall averaged for some years previous to 1882, 13 inches.³ The surveyor estimated in 1882 that if improved to its full capacity⁴ (so that drinking water might be had wherever required), this land could or might carry 120 to 130 sheep to the mile. It is, however, clear that if seasons like the last three, 1883-5, are to recur—as recur they will—this estimate is very high. Half the sheep there have died for want of grass.

3. The “good lands” of the interior of New South Wales, that carry a sheep to the acre, have a rainfall of 19 or 20 inches, and a first-rate soil.

4. In the state of Buenos Ayres,⁵ which I take as a wide, flat, uniform, open country, with the same mean temperature as that last-mentioned, the numerical density or distribution of sheep and cattle, is recorded in the census of 1881, and the numbers returned are supposed to be much below the reality. It appears by the census that the twenty-two counties lying north of the Salado and west of the capital, where there is a

¹ The *Government Handbook* says, at p. 155, the carrying capacity of pasture land in South Australia varies from 40 to 640 sheep to the mile, in its *natural*—i.e. unimproved—state (*sic*!).

² And with every prospect of having greater security for improvements given by forthcoming legislation.

³ See a kind of rainfall map appended to the Report of Messrs. Ranken and Morris on the state of the public lands of New South Wales. This is the Report on which the new land laws of 1885 were based. It is printed in vol. ii. of the *Votes and Proceedings of New South Wales* for 1883, and is a work of great thoroughness and geographical value.

⁴ P. 134 of Ranken and Morris's Report. Later and detailed returns of the estimated capacity of each run in the western districts, when fully improved, made in order to see where Crown rents could be raised, are also given in *Votes and Proceedings*, 1883-4, vol. iii. p. 265. They show a very small margin of improvability indeed.

⁵ Buenos Ayres has the same mean temperature as Forbes and Dubbo on the plains, Central New South Wales, long. 148½ E.

rainfall of about 34 inches (and where the finer grasses which therefore can be made to grow there have been fairly generally introduced), are stocked at the rate of 2630 sheep to the square mile. Cattle and horses are included in this figure, reckoned as equivalent to so many sheep.¹

5. *Under irrigation*, the Californians affirm that an acre of lucerne will keep twenty sheep, if it is cut for them. It will certainly keep over ten.² The amount of irrigation and rain is not more than 60 or 100 inches a year for the 10 or 20 sheep respectively, and is probably more like 53 and 84 inches.

These figures show progressive rates of increase, thus :—

District.	Rain.	Sheep per mile.	Increased capacity for every inch of rain, etc., added.
1. South Australia, .	Say, first 8-10 inches.	8-9?	about 1 sheep p. mile.
2. New South Wales, .	9 + 4 "	96	" 22 "
3. " " " "	9 + 4 + 7 "	640	" 70 "
4. Buenos Ayres, .	9 + 4 + 7 + 14 "	2630	" 140 "
5. Californian lucerne, }	34 + 26? "	12,800	} over 145, ⁵ and probably more like 200.
irrigated, . }	34 + 66? "		

These figures show, as far as their looseness permits, a progressive increase, thus :—

District.	Pastoral Capacity Increases for every Extra Inch of Rainfall at the rate in Sheep per Square Mile.
1	Of 1 sheep for every inch of rain over absolute desert.
2	" 22 " " " over No. 1.
3	" 70 " " " over No. 2.
4	" 140 " " " over No. 3.
5 (a)	" 145-200? " " over No. 4.
5 (b)	" 145-200? " " over No. 4.

5 (b) Is a case of 20 sheep fed on an acre of lucerne which gets 84 to 100 inches of water a year.

This progression is what one would expect. In dry districts the

¹ See p. lviii. of the Census, which assumes that 1 cow=8 sheep, and a horse=6. A not inconsiderable part of the area, not deducted, is under cultivation. The total area of this solid block of counties is 12,272 square miles: sheep 20·43 millions, cattle 0·89, horses 0·47 millions. It is supposed the live stock figures are 15 per cent. below the reality, taking the State as a whole. There is also a large area with 1550 to 2070 sheep units per square mile, with a less rainfall, but capable of being better grassed than at present. The increase of stock from 1881 to 1882 was supposed to be 10 per cent. on the total numbers in the State.

² *Report on Irrigation in America*; *Victoria Votes and Proceedings*, 1884, vol. ii.; and Mr. Gipps' paper to Royal Society of New South Wales, p. 326: "There are 1000 acres of flat, sandy land in the San Joaquin valley, which in their natural state would have fed one sheep to the acre; irrigated and growing alfalfa (lucerne), it now feeds twenty to the acre."

³ A very few horned cattle are also kept in this part.

⁴ If fully improved.

⁵ Not the full actual numbers.

⁶ Suppose an acre of lucerne required 60 inches of water and rain in order to feed 10 sheep, it would carry 145 extra sheep per inch of excess over No. 4.

evaporation is enormous,¹ and even at Adelaide an inch of rain in the summer "only washes the dust off the leaves." A small annual rainfall never soaks in.

So far for pasturage. Let us next take wheat. Here we have some very reliable data from South Australia. Mr. Todd has compared the variations there in mean rainfall from one year to another with those of the annual wheat-yields. The agricultural area is small, compact, uniform in climate, soil, and general character, and a great part of it is sown with wheat, and very little else is grown at all.² It has been thickly covered with rain-gauges ever since 1861, under Mr. Todd's directions, and he has chosen carefully, before making his tables, those rain-gauges which he considers together give or correctly represent the mean fall of rain on the areas under wheat. Moreover, as new wheat districts have sprung up fresh rain-gauge stations have followed them. Some of those chosen are only nine years old, because they have "followed" the wheat crops. There is no other crop, indeed, to follow. Until 1880, the area of cultivation whose yield is returned did not to any great extent overstep the districts whose rain is measured. In 1880-82 it did. Till then, gradual improvements in cultivation seem to have counterbalanced the partial exhaustion of the soil in the older districts. The conditions therefore are favourable for an induction.

Comparing the mean rain of the winter *sic*³ months with the harvest yields, and grouping the years in sixes, to eliminate to some extent the variation from one single year to another of other conditions affecting the harvest, it appears that the difference in bushels per acre of average yield is almost exactly the same as the difference in inches of rain: 18 inches give 12 bushels, 15 give 9, and 12 give 6. In fact, the difference between the number of bushels and inches is constant, and is just about 6. The tables so arranged and averaged are as follows:—

Averages of groups of years.	Rain. Inches.	Yield. Bushels.	Inches minus bushels.
7 best years (11½ bushels and over), . .	18.47	12.43	6.04
5 next best years (8 to 11 bushels), . .	15.28	10.02	5.26
6 bad years (5 to 8 bushels), ...	13.55	6.61	6.92
Total 18 years, 1861-1879, excluding 1867, ...	15.76	9.69	6.07
3 years (1880-82) when wheat was grown beyond the rain-gauges in drier parts, ...	13.22	4.58	8.64

¹ Chapter by Mr. Todd in Marcus's book on South Australia. At Bourke the annual evaporation is 85 inches.

² The southern part had been extensively cropped long before 1861.

³ Excluding the year 1867, when red rust, due to heavy rains in very hot weather just before harvest, almost wholly destroyed the yield. Mr. Todd has finally fixed upon a six-month period in preference to seven or less. He leaves us to draw our conclusions and frame our own equation from inspection.

An *extra inch* of rain in the season on the little area of South Australian wheat lands—some two million acres—would give it an additional fee-simple value of *ten million pounds*, if wheat at 4s. a bushel or equivalent crops were grown. If the whole area inside Goyder's line—some 8000 square miles—profited equally by the same increase of rain, it would be worth a million a year more than it is now. The rental of the whole present herbage in the central two-thirds or three-fourths of Australia, outside Goyder's line, where there is less than twenty inches of rain, if it was fixed at 6d. per sheep, which is the rate just fixed by the Victorian Government in leasing the north-west quarter of Victoria,¹ would not be worth² more than this extra inch inside Goyder's line.

The average distribution through the six winter months of the rain, from which these results are obtained, is as follows :—2·99, 2·80, 3·01, 2·57, 2·15, 1·87 inches, in the several months May to October; the total fall in the hot season being just over 6, of which 1½ falls in April. The mean winter temperature (June-August) at Adelaide is 53·1°; that of the year is 63°. Wheat is sown about the first of June, and is harvested late in November or in December. No doubt, under very favourable conditions, every inch would go a good deal further in the production of wheat. Wheat likes a cool, moist season for sprouting and tillering,³ and would give greater yields if May, June, and July were colder, and had a greater proportion of the total rain of the season. In New South Wales, however, along the 10-inch winter rainfall line, the temperature is rather higher than in South Australia. Farther east, on the watershed and high grounds at 2000 feet above the sea, of course it is cooler. Towards and beyond the Queensland border, wheat culture is almost entirely confined to such altitudes. In 1881,⁴ all the unruined wheat in Queensland, except some 200 acres, was reaped inside the two small police districts of Warwick and Toowoomba, close to the watershed; the acreages where the crop was spoiled by rust, both inside and outside

¹ In the centre of Victoria, where meat as well as wool can be marketed, rates are higher.

² Could it carry 40 million sheep? In 1881-83 there were in Queensland on the west side of the dividing ridge 10 millions; in the west and central two-thirds of New South Wales about 20; in South Australia 6½; and in West Australia 1½ millions—a large part of the sheep in these two last colonies being without this area.

³ "The ideal climate for wheat is one with a long or rather wet winter, with but little or no frost, prolonged into a cool or rather wet spring, which gradually fades into a warmer summer, the weather growing gradually drier as it grows warmer, with comparatively light rains after the blossoming of the crop, just enough to bring the grain to maturity, and abundant sunshine and rather dry air towards harvest, but without dry or scorching winds till the grain is fully ripe, and then dry hot rainless weather till it is harvested. . . . A warm dry rapidly growing spring diminishes the yield, as the branching or tillering must take place before the plant gets far above the surface, or else it does not occur at all."—Special Report on Cereal Production, by Prof. W. H. Brewer, United States Tenth Census (1881), vol. iii. p. 63, of that Report. "These conditions," he adds, "are more nearly realised in the better years in Southern California than anywhere else in the States. The better years of course mean the wettest. In point of spring temperature, if not in distribution of rain, Victoria would be rather better than South Australia."

⁴ I quoted this fact in a previous article upon Australian Government publications.

those districts, being somewhat greater than what was left clean. It is the bursting of the summer rains before the crop is ripe for harvest that causes rust; to sow early so as to avoid this, is to sow whilst it is very hot. The wheat-grower is on the horns of a dilemma.

Wherever it is true that on the average $6+x$ inches of rain in the six months are required to produce x bushels an acre, it will hardly pay expenses to grow wheat even at a price of 5s. a bushel on the farm, unless there is 10 inches of winter rainfall; for the cheapest style of wheat-farming in the world on big machine-using farms costs just £1 an acre,¹ all just allowances included. I therefore suggest that the 10-inch line on the second map is not far from the limit of wheat or other cultivation.

Maize culture will probably find its limit in a climate such as that of inland Queensland, where there is 20 inches of rain in the six wet summer months. The Signal Service Department in the United States has just begun a course of comparisons to see how far the yield of maize (and other staple American crops) varies with the rainfall of the season. The only set of tables already published by them are, however, introductory, tentative, and inconclusive.² Parts of Texas resemble in climate Queensland, Natal, and Zululand, and parts of California, the southern Australian coasts; but, as a rule, American climates and Australian are not comparable.

The limit of the heavier rainfalls (40, 50, 60 inches a year) are of interest as affecting sugar-planting. On the Burdekin delta (just 40 inches) irrigation is already being resorted to, and is found to be almost necessary.

Reasoning from the South Australian figures, I have called the limit of ten-inch winter rains in a great part of Australia the limit of agriculture. Let us test this by facts. Of course where the soil is very good, it will pay to farm with less rain; but as a fact, on the whole, there is very little permanent unirrigated culture beyond this limit. In New South Wales, where the lands on the dividing ridge and coast slopes are for the great part of very bad quality—and are also, especially on better soils, overgrown with bush and timber—persistent efforts have been made by Government ever since 1861 to settle agricultural colonists on the western plains. The attempt has utterly failed, and the above-quoted Report of Messrs. Ranken and Morris states the reasons of the failure of the previous land laws in this respect in very plain language. Speaking of the present Central Division and of the part of the Eastern outside the old settled districts, they say, "In 95 per cent. of this division an arable patch is worthless unless a certain amount of pasture is attached;" (the "patch" means the statutory square mile), and they then find upon the voluminous evidence before them, and in

¹ According to Mr. Bell's (Bell Farm, Manitoba) last estimate. The lowest figure on a small farm that could be quoted (some few years ago) by Messrs. Close and Benson, Iowa, on a 240-acre farm, farmed by similar methods, was nearly double.

² *Professional Papers of the Signal Service Department* (of the War Office) No. x. The areas arranged are, one would think, too wide and diverse. Small uniform areas carefully selected ought to give more instructive results.

accordance with "a general uniformity of opinion," that the least amount of pasture which will suffice to give a fair livelihood to a working family is 3 or 4 square miles, the latter being the figure more generally applicable. "It might have been recognised," say the reporters, when the old land law of 1861 was passed, "that settlement westward must in such a climate be based on a secured use of pasture."

As a matter of fact, there were in 1882 only 44,000 acres under cultivation in the (now) Central and Western Divisions, which is equivalent to a strip some 30 yards wide stretched across New South Wales from Victoria to Queensland. These two divisions cover two-thirds of New South Wales, and the east edge of the Central Division roughly corresponds to the 10-inch winter rainfall line.

In the Western Division, "the evidence showed" the Commissioners "that 9 square miles¹ is the least area that will form a homestead or allow of beneficial occupation." "These lands," they add, "were unlocked, or opened to settlement at the cost of £3,000,000, and only 300 householders, whether shanty-keepers, 'dummies,' or *bona-fide* selectors, have entered in, and it has cost the State therefore £10,000 a head to settle them temporarily on this land,—the rainfall being under 10 inches a year.

As regards lands in Victoria, not only outside but well inside the 10-inch winter rainfall limit, the Chief Secretary has just stated that "this further knowledge has been gained: that if agriculture is to be maintained at all in the northern areas of the colony, irrigation must be practised on a considerable scale. The experience, from 1875 to this day, of those who have attempted cultivation there, is one of painful failure, deprivation, and loss. If agriculture on the northern plains *has to be renounced*, it will mean the loss to us of a large number of the very best class of our population, . . . of men who, by their energy in other spheres of life, have contributed to make Victoria what she is. In fact, unless this area is irrigated, the population will be swept away, and the land must go back simply to sheep-farming."²

In South Australia, outside Goyder's line, the average rainfall at the nine oldest rain-gauge stations, which are mostly near the line, is 8 inches in the wettest (and coolest) seven months.³ Since 1880 the virgin soils here have been cultivated,—of course in picked spots, and wherever there was most rain. The extent under wheat, which is there the sole crop, was in 1880-82 over 500 square miles.⁴ The average yield therefrom in 1880-82 was just 3 bushels an acre,⁴ and in 1882, when the average rainfall of six counties, which comprise the bulk of the ploughed land outside the line, fell to 6·2 in the six months,³ the yield³

¹ This figure has also been adopted in the Land Act. But in May last no one had applied for any such block there, because of the difficulty as to water-supply.

² Page 25 of the reprint of the Hon. A. Deakin's speech.

³ Todd, *Report* for 1882, pp. 18 and 21.

⁴ "Statistical Map of Wheat Production" in the Royal Geographical Society's map-room. Catalogued as v. 8, 17 * * In deducing any formula from Mr. Todd's tables, this extension of wheat area beyond rain-gauges since 1880 must be taken into consideration.

in them was $1\frac{2}{3}$ bushels an acre. Since then it has been worse still. The farmers there have been generally throwing up the lands for which they had paid the deposit and part instalments of purchase-money, where the Government has not reduced the price. Thousands have been ruined.

AGRICULTURAL AREA OF AUSTRALIA.—The area of land in Australia outside the tropics, and within the 10-inch winter and 20-inch summer rainfall lines, as here traced (including West Australia), is less than 240,000 square miles—less, that is, than Austria-Hungary.

Unfortunately Nature, which has given Australia both rain and magnificent soils, has in large measure withheld the one gift where she bestows the other. The two gifts lose most of their value, because they do not coincide. If the heavy rains fell on the good soil Australia would be rich enough. The old settled districts of New South Wales, which form the central three-sevenths of the Eastern land division, cover some 40,000 square miles. They comprise "great stretches of waste, not only the most sterile in New South Wales, but about the poorest (as regards soil and capacity for production) in Australia." In one half of this land division (the Central and North-Central half), comprising, as it does, some of the best lands in the colony, settled for the last sixty years, and with easy access to the capital and to the sea-board, "more than half the area is too poor to be occupied with advantage under any tenancy." The same description applies to most of the coast slopes south of Sydney. "Limited spots of fertility" are there "interspersed among rugged and densely timbered ranges, while much of the country is so barren that its occupation is not likely to be hastened by any legislation;" and "as for the *unsold* land in the old settled districts generally, nine-tenths of them, according to a competent witness, would be dear at 5s. an acre," and in no part of the table-lands about the dividing ridge that he had seen would the land keep a sheep to the acre, "though by improvement it could be made to carry one and a half."¹ As a rule the soils overlying the extensive coal measures here and in Queensland are poor—for instance, those on the Upper Hunter.

In West Australia a large part of the rainy corner is sandy and very inferior.

The better soils on the coast slopes in Australia, where there is a rainfall of 30 to 38 inches and more, are generally heavily and thickly timbered, and the cost of clearing such land has been put by the Chief Secretary of Victoria as high as £10 an acre.

In the interior, on the other hand, where the streams issue out on the almost treeless plains of the Darling and Murray basin, there is generally rich soil, and a climate very like that of South California or the Cape,

¹ These quotations are from the Report of Messrs. Ranken and Morris, slightly condensed, but not altered in phraseology. The witness last cited had apparently spent half his life in the profession of prospecting for good spots under the free selection system. See further the details in the appendices to the Report.

excellent for viticulture. But the supply of water in these streams, like the rainfall on these plains, is very small.

This water-supply has been measured. The average discharge of the Murray at Albury, together with that of all the waters it receives from New South Wales below Albury (for a period of five years, 1879-84), was estimated to be equal to a mean continuous flow of 11,500 cubic feet a second. Nearly one-third of this was at Albury. A great proportion of the other two-thirds flows in summer floods, which it is not easy to utilise.

The other *available* waters of the Murray basin (*i.e.* its tributaries in Victoria) amount apparently to about 1000 cubic feet ¹ per second per annum; but here winter rains prevail, and the average flow in the winter half-year is 1300 cubic feet a second. The estimated amount of land which could be irrigated thereby, 10 inches deep in winter, is 560,000 acres, or 875 square miles, and 230,000 acres, or 359 miles, could be also irrigated in summer 15 inches deep.² The total average amount of water flowing into the Murray at or below Albury is hardly one-seventh of the average flow of the Rhone, or of the Po. The so-called rivers of these interior basins, so conspicuously marked on the map appended to this article, are mostly miserable things, flooded once or twice a year for a few days, and almost dry for the rest of the year. Arabs would call them "khors" or "wadys."

South Australia has no running waters at all worth mentioning, except the Murray, which Victoria and New South Wales hope to use up between them.

IRRIGATION.—The value of water artificially applied to land by irrigation can be proved more directly than the value of rain. There are data in several countries similar in climate to South Australia, Victoria, and the interior of New South Wales.

In the Punjab the excess of yield on irrigated lands over that on dry lands averages 10 bushels an acre: the amount of added water averaging 10 inches. The water is used wastefully and to excess—in fact, some lands have been super-saturated.

Wheat-growing, however, to quote the Chief Secretary of Victoria, the author of the new Irrigation Act there, is the "lowest and worse" use of irrigated land, though, for all that, it is widely practised at present in the Rocky Mountain States of America.

In South Australia it has been found that fruit-growers are perfectly able to pay ³ 2d. or 3d. per 1000 gallons (3s. 9d. to 5s. 7d. per inch upon an acre) to grow irrigated fruit, and export it to Europe at a profit.

¹ It is calculated that this amount can be put on the land: some would be lost by soakage, evaporation, etc., before it got there.

² Table appended to Hon. A. Deakin's speech on water-supply. Part of the Murray water at Albury belongs to Victoria. I cannot find the actual measurements of the streams.

³ Speech of the Honourable A. Deakin, Chief Secretary of Victoria, as reprinted, p. 60. (To be had at the Victoria Government Agency in London.)

In Spain the peasants of Murcia, who, according to M'Culloch, are "proverbial, even in Spain, for their indolence and apathy," buy their water every morning during the irrigating season at auctions. The average price at Lorca of the water so sold is 5s. 4d. per inch on an acre, which is equivalent to £2300 *per annum*¹ for a constant perennial flow of a cubic foot a second: and Mr. Higgin gives the Lorca price as a fair example.

In California it seems that in more than one place vine-growers have been paying 5d. per 1000 gallons (9s. 6d. per inch per acre) for water.

In the Cape first-class lands at Oudtshoorn, with water attached, have fetched prices running up to £250 an irrigated acre. Dry lands would be worth at the very outside £3. This price, however (and probably the flow of water also),² is small compared to the Spanish: for in the irrigable districts of Murcia and Valencia, where land and water are owned and sold together, irrigated lands, with the water that it is customary to use and enjoy therewith, fetch from £250 to £400 an acre, according to quality and situation: dry lands in the same, *i.e.* irrigable districts and neighbourhood, are worth from £7 to £20 an acre, the latter being quite an outside price.³

Presuming the value of water in Murcia and Valencia generally to be the same as at Lorca, it follows that some 94 inches of water a year are usually therefore (and profitably) used up on the good lands irrigated, and this must be during a period of probably not over nine months, since the streams dry up in summer. As oranges are widely cultivated, and as rice used till recently to be the staple crop in Valencia, this is not strange.

The value of water in South California, the Cape, and also in Australia, is enhanced by the cultivation of the vine. Their climates are exceptionally favourable; for the vine, if it had sufficient moisture below, yields most and best in a very hot dry summer like theirs.

As stated above, every five inches of rainfall that can be collected off a given catchment area, and brought to market at Spanish prices, is worth as much as the same area of first-class irrigable, but unirrigated, land in Valencia itself. This is worth noticing, since the natural rainfall at Valencia is 17·7³ inches per annum, or 12 inches in the winter six months; yet this and the land together are only worth £20 an acre at the outside. If the rainfall upon one acre all fell in one corner and left the rest desert, the property would apparently be greatly improved as a whole.

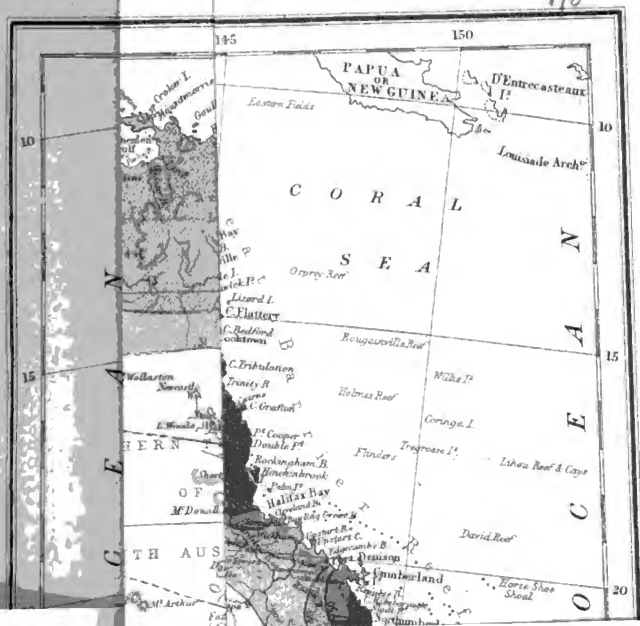
As a further deficiency of rainfall would have to be made up by pur-

¹ *Commercial and Industrial Spain*, p. 93. In the notice of this book in the last May number of the *Scottish Geographical Magazine*, the "per annum" was omitted.

² For wheat fetches 5s. to 6s. 6d. a bushel at Capetown, this being the range of price in the last five years, and it does not appear to be grown much under irrigation. If water was worth less than it is at Lorca it would be irrigated.

³ This is for the years 1857-74 and 1876-80: at Murcia (for 16 years) 12·7, at Alicante (for 25), 13·6 inches.

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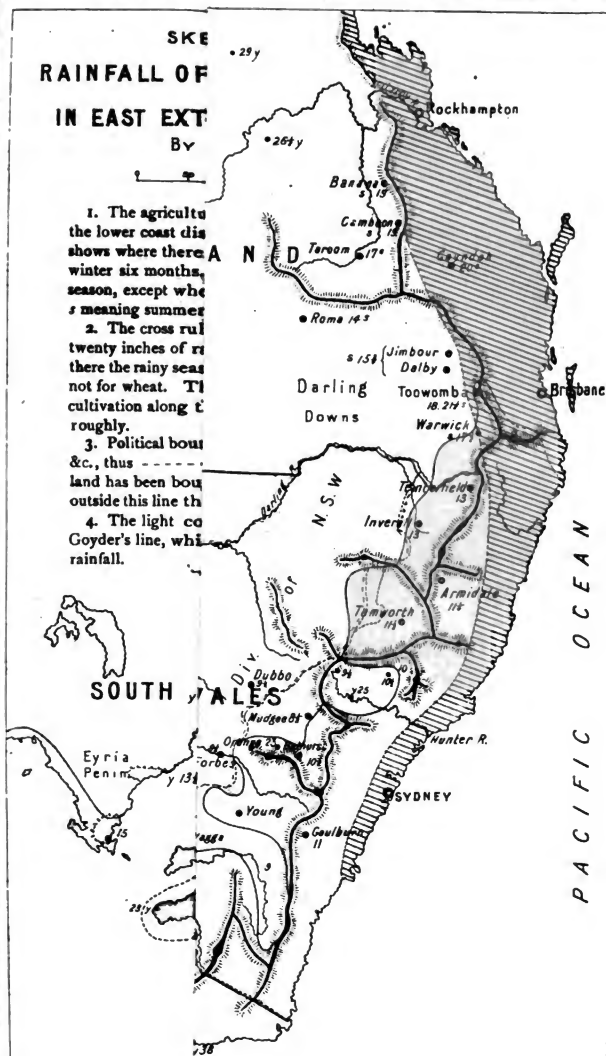
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chasing water at some 5s. per inch per annum on each acre, the very best land, if it had only 8 inches of rain in the winter, or 12 annually, would be worth next to nothing¹ even on the Mediterranean coast, and this, I believe, is the fact why these dry areas or *despoblados* are uninhabited and unused.

Irrigation manures as well as waters the land, but the value of the silt it deposits varies very much. The crops on the delta of the Kistna (Hindustan) are said to be 50 per cent. better than those on the adjoining delta of the Godaveri, on this account.² One must therefore reason with caution about water-values.

It should be mentioned that proper irrigation in any country is impossible as long as the English common law of riparian rights prevails. Victoria intends to abolish it root and branch, and to vest the ownership of all running waters in the State. In California a recent decision of the Appellate Courts of the State upholding it has brought all irrigation enterprises to a standstill, and it will oblige California to do the same, unless she prefers to see South California secede and become a separate State.

Our law says that water ought to flow as nature makes it flow. In a dry country this is to waste it entirely. It ought not to be allowed to flow thus an instant longer than can be helped. The law says that each riparian owner is entitled to the use of a reasonable amount. One might as well make a London street fountain run with good wine, and say that each man in London should drink from it reasonably, or send a cartload of sovereigns down Whitechapel, and say that every householder, especially the last one in the street, was entitled to help himself to a reasonable amount.

Has South Australia any right to have water flowing in the lower Murray? The question will soon require, I fancy, the decision of the Privy Council. New South Wales will soon follow the example of Victoria. South Australia is already securing a Californian firm of irrigation-work contractors to see how best to divert the Murray in South Australia. If any water is to flow there, a most inordinate amount will have to be let flow down from above, for three-quarters or more of a small flow will soak, evaporate, and waste away in the long and slow descent, all of which will soon be worth £2300 per annum for every cubic foot a second of annual average flow.

Investors and promoters of emigration would, I think, do well to consider and verify the considerations above stated with reference to the value of rain and irrigation water, and to the scarcity of both in Australia.

¹ One must reckon fee-simple value at about sixteen years' purchase (6 per cent.) in Spain, according to Higgin.

² See General Sir A. Cotton's letter to Mr. M'Coll, the persistent advocate of irrigation in Victoria. *Papers presented to the Legislative Assembly, Victoria, 1883*, vol. i., in a return on surface irrigation.

SIERRA NEVADA DE SANTA MARTA.

By J. T. BEALBY, B.A.,

Assistant Editor, Scottish Geographical Society.

THE mountain system which bears this name lies approximately between the limits of $72^{\circ} 30'$ and $74^{\circ} 15'$ W. long, and $9^{\circ} 40'$ and $11^{\circ} 25'$ N. lat., in the State of Magdalena, one of the members of the Colombian Confederation, in South America. The group is an interesting one for two reasons. First, the question whether it has any connection with the northernmost extension of the Andes, which at one point approaches it within six miles, or whether it constitutes an entirely independent system, is one of those problems in physical geography which have a fascinating attraction for the scientific mind. The second reason is one which has grown up out of the first, already stated: the problem as to the formation and probable connection of the system with the Andes has been made a subject of discussion by geographers, amongst whom, however, there does not prevail a unanimous consensus of opinion.

The question has been studied, and the region written about, by various travellers and men of scientific training during the last forty years. The Italian Codazzi, after surveying Venezuela, and embodying his labours in a fairly good map of that country, proceeded to do the like service for Colombia, and had accomplished the survey of all the States of the Confederation, except the two on the north coast, when he was carried off by fever in Espiritu Santo in February 1859. In 1851 the Colombian Colonel Joaquin Acosta explored part of the system, and penetrated to the snow-line. About the same time the German botanist, Hermann Karsten, studied the botany, and to a slight extent the geology, of the region. But the first explorer to give any connected account of it was Mr. F. A. A. Simons, who, in 1881, read a paper on the subject before the Royal Geographical Society of London.¹ Four years later Dr. Alfred Hettner gathered up all the facts in relation to the Sierra Nevada de Santa Marta in a short article printed in *Petermann's Mitteilungen* (1885, pp. 92 sq.). Lastly, in February of last year, Dr. W. Sievers made the first attempt at a geological study of the system, and he has published a preliminary account in *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* (Bd. xiii., No. 8, 1886), supplementing this paper with another in the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* (Bd. xxi., Heft 6, 1886)² on the native Indians who inhabit those mountainous regions.

OROGRAPHY.—The Santa Marta mountain group lies between the sandy peninsula of Goajira (which bounds the Gulf of Maracaybo on the west), the Caribbean Sea, the low swamps and marshes of the Rio Magdalena, and the Rio Cesar. In shape it resembles a rectangular triangle, having its right angle at the town of Santa Marta on the north-

¹ See *Proc. Roy. Geog. Soc.*, 1881, pp. 705 sq.

² "Die Arhuaco-Indianer in der Sierra Nevada de Santa Marta."

west; its hypotenuse is the Rio Cesar, which flows in a general south-westerly direction, and joins the Rio Magdalena at El Banco; the remaining sides are formed by the sea on the north, and the marshy lands of the Magdalena on the west.

The culminating point or centre of the system is the double peak which gives its distinctive name to the group—the Sierra Nevada de Santa Marta. This central knot, seen from the sea or the valley of the Rio Cesar, appears as two closely-linked peaks, but in reality consists of two tables, and from eight to ten separate summits, all capped with snow. Its altitude is differently estimated by Simons and Sievers, the former putting it at about 17,500 feet,¹ the latter at 16,400 feet.² In keeping with this discrepancy,³ they also estimate the height of the snow-line differently: while Sievers makes it out to be 15,000 feet, Simons states that at certain seasons it descends as low as 9000 feet, and adds that it varies with the time of year. The main snowy range runs in an east-west direction, and this is also the general bearing of the component and outlying ranges on the south-west. Those on the south-east of the main chain have a more complicated formation, which is described lower down.

Below the Santa Marta, properly so called, on its southern side, the principal feature is a huge basin, sunk 1600 feet between two of the principal constituent chains of the group, having precipitous walls of rock and containing remains and traces of both side and end moraines or glaciers. The east end of this deep lateral depression is formed by a connecting ridge running at right angles to the side ranges, which are called respectively the Kungukaka (on the north) and the Curucata or Chucuauca (on the south). These two ranges approach each other very closely on the west, only leaving room for the exit of the river Cataca, which has its origin among the snowy heights at the east end of the depression. The altitude of these two chains, as well as of another parallel chain situated to the south of them, and called Chinchicua, averages from 13,000 to 16,000 (or 17,000) feet. The western slopes of the system do not seem to have been explored. The only information we have concerns the culminating point of the extreme south-western outlier, which bears the name of Alta de las Minas, and reaches an altitude of not more than 1000 to 1500 feet. From this we may infer that the western extremities of the chains in this part of the system have very steep gradients towards the Magdalena swamps and marshes.

South-eastward, at the foot of the snowy peaks of the Santa Marta, the principal ranges suddenly change their direction: instead of running east-west, they bend abruptly to the east-south-east, but soon turn again, however, to take—first, a south-east, then a south-south-east trend. Where this change in direction is first effected, the passes or ridges are

¹ *Proc. Roy. Geog. Soc.*, 1881, p. 708.

² *Verhandl. d. Gesellsch. f. Erdk.*, Bd. xiii., No. 8, p. 400.

³ Felipe Perez, in a book on the *Physical and Political Geography of the U.S. of Colombia*, published in 1863, estimated the height of the Sierra Nevada at 28,000 feet.

so narrow that at one place there is only room for a single beast of burden, whilst on either hand yawns a precipice of nearly 3000 feet. In fact, to cross from the village of San Sebastian, which lies north of the Chinchicua range, to Atanquez, the administrative centre of the district, the traveller has for several hours to make a descent of nearly 1000 feet an hour. In this part of the system the mountains form short ranges, very steep, and full of fantastically-shaped needles, horns, minarets, pyramids, and projecting bosses. In the deep narrow valleys lying between, numerous water-courses have their origin, which flow southwards to join the Rio Cesar.

One portion of the main chain, however, instead of trending south-eastwards, continues to follow a due easterly direction, at least for a time; for it soon bifurcates, sending off one branch to the north-east, whilst the other continues to pursue the prevailing west-east direction characteristic of the western chains of the system. This last branch, after proceeding for a time with a due easterly trend, likewise bends round to the east-north-east and north-east, finally disappearing, like its fellow, the true north-eastern branch of the main chain, in the sandy plains of the Goajira Peninsula. Both branches have a steep descent towards the east. At about $73^{\circ} 18'$ the north-eastern branch has already sunk down to 4600-5200 feet; the southern branch in about the same longitude has an altitude of 5500 feet.

Beyond these two branches of the main chain, on the east and south-east, comes a hilly region of peculiar formation, and barely exceeding 3200 feet in height. It bears the name La Sierrita, and differs in geological formation from the central mountain mass of the Santa Marta. But to understand properly this part of the system it is necessary to consider the geology of the region, including that of the Andes range, which here approaches close to the Santa Marta.

The Sierra Nevada sends out a branch towards its north-west angle, which, after forming a secondary nucleus in San Lorenzo, terminates at the sea-coast in Cabo de la Aguja or Needle Point, a little to the north of the old town of Santa Marta, the capital of the State of Magdalena. The San Lorenzo is so densely wooded as to be almost impassable; and by its numerous spurs it makes the coast-line very irregular and precipitous. Beyond these meagre facts, next to nothing seems to be known about it.

GEOLOGY.—The central nucleus—the snowy range and those in immediate connection with it—consists almost entirely of granite, together with some crystalline slates. The east-west chains in the western part of the system are composed of granite and syenite, which in the neighbourhood of the town of Santa Marta—the San Lorenzo—are surrounded by external layers of crystalline, micaceous, and green-coloured slates. On the extreme south-west, the Alto de las Minas is built up of red sandstone and porphyritic quartz, and the savannahs of the Rio Cesar, still farther to the south, are underlain by red argillaceous sandstone, which is frequently cupriferous and

often seamed with porphyritic quartz. A low range of hills, composed of porphyritic rocks, and having a north-north-east strike, flanks the south-eastern slopes of the Santa Marta group, extending apparently from end to end of the entire mountain-mass, and forming the north-western boundary of the Rio Cesar valley. The Sierrita, which stretches beyond the north-eastern extension of the Rio Cesar, is made up of many older eruptive rocks, variously arranged, and partaking in part of the character of greenstone. This hilly tract lies around the head-waters of another river, the Rio Rancheria, which for some distance continues the Rio Cesar valley in the same direction, but itself flows north-eastwards (not south-westwards like the Rio Cesar), and finds an outlet in the Caribbean Sea, near the town of Rio Hacha, to the west of the Gulf of Maracaybo.

Opposite the southern angle of the Santa Marta triangle, across the Rio Cesar valley, to the east, a little below latitude 10° north, the Andean Cordillera, which at that part bears the name Sierra de los Motilones, from the native Indian tribe who inhabit its western declivity, attains an altitude of about 8200 feet. With a northern trend, which coincides generally with longitude 73° W., the Andes gradually approach the Santa Marta; this part of the Cordillera, which is called the Sierra de Perija, is probably about 9000 feet high. Along its western side run lower ranges of foot-hills of the same porphyritic formation as the range which flanks the opposite side of the Rio Cesar valley. At the point where the Andes approach within six miles of the Sierra Nevada, they make an abrupt bend to the north-east. Here is their culminating point in the north, the Cerro Pintado, as they are called at the elbow, rising to about 10,000 feet. From this point the Cordillera falls away in easy curves, but with a rapid descent, towards the Goajira Peninsula.

The Sierra de Perija, which, it will be remembered, has a northern trend, has an entirely different geological formation from the Sierra Nevada. Its western outliers rest upon the same porphyritic quartz as that of the opposite exterior edge of the Nevada; but there the resemblance ceases; for upon this rock is superimposed a mass of red argillaceous sandstones, which seem to be non-fossiliferous. These sandstones, in conjunction with conglomerates, constitute the essential part of all these foot-hills up to a height of 3200 feet, and even to 8000 feet in the Cerro Pintado. Dr. Sievers¹ suggests that this porphyry formation may be identical with that which is alleged to occupy a peculiar position in the Argentine Republic and in Chili, and which is assigned to the Mesozoic age. The whole of the upper portions of the Cordillera consist of thick strata of limestone, which must be counted as belonging to the Chalk. They constitute the principal element in the highest summits all along the range, but are also found in places as low as 2900-3000 feet. Their strike is mostly from north-north-east to north, turning to east-west

¹ *Op. cit.*, p. 404.

beyond Cerro Pintado, and they are faulted at a very steep angle against the Sierra Nevada. A little to the south of 11° N. latitude, Dr. Sievers avers that the two systems—the Andes and the Santa Marta—unite, the junction being effected within the curve which the Rio Rancheria makes in turning from north-east to north, before reaching the Caribbean Sea, and within a triangle formed by the towns Fonseca, Treinta, and Soldado.

In this district the Sierrita has its strike in the same north-north-east direction, towards Treinta, as the Cordillera; and consists of rugged hills of granite, syenite, and dioritic porphyry. On the culminating point of this hilly region, at an altitude of 3600 feet, sandstones, tilted into a perpendicular position, suddenly make their appearance. They contain fossils of the Chalk formation, and have the same structure and properties, and are of the same age, as the sandstones of the Cerro Pintado, and consequently exhibit distinctively Andean characteristics. Also, on descending from this point east-south-eastwards into the Rancheria valley, one crosses a series of limestone ranges all having a north-north-east strike, and partly lying steeply inclined towards the east-south-east. On the Rancheria itself, about 330 feet above its bed, the strata underlying this limestone become distinctly visible. They are of the same yellow and red colour, and of the same cretaceous and marly constitution, as the sandstones of which certain lower parts of the Andes chain are built up. The same strata are continued on the opposite side of the river, conjoined with a much disturbed system of alternate layers of grey and white quartzose sandstones, mixed with coal, and belonging probably to the Mesozoic era, or perhaps even one still younger. Between these precisely similar strata of the Cordillera and the Sierra Nevada, the Rio Rancheria has cut its way, in a narrow cañon; that is, in an isoclinal not a synclinal, valley.

The Andean limestone strata are also found somewhat further to the south-west of the Sierrita, where they are separated from the rocks lying to the north of the Rio Rancheria (which here flows nearly east), by being pushed forward, and are torn by a double rent both in strike and in dip. Through this gap the Rio Rancheria finds its way out of the Sierra Nevada.

To sum up the results. Throughout the whole of the eastern half of the Sierra Nevada the crystalline primitive rocks show distinct marks of stratification, and are characterised by the same strike (north-north-east) and the same dip (south-south-east) as those which prevail in the Cordillera of the Andes. In the west of the Santa Marta system the chains have an east-west trend; and this is in part the lie of the strata as well, as appears in the clay slates and sandstones of the savannahs and the Alto de las Minas. The stratified rocks of the Sierra de Perija reappear in certain spots on the other side of the Rio Cesar valley, on the south-eastern face of the Santa Marta system, but only on this side, and not to a greater height than 3200 feet. All the rest of the Sierra Nevada—that is, the

main bulk of the mountains—is much older than the Andean Cordillera. The mountains which lose themselves in the Goajira Peninsula seem to belong to the Sierra Nevada, and may possibly belong also to the Andes. But this can only be settled by a scientific examination of their constituent rocks.

Before giving a brief account of the hydrography of the system, a few words descriptive of the northern slope must be added. Beyond the central snowy chain the descent is at first very gentle, but as the mountains approach the sea it soon becomes very steep. The geological constitution of the rocks is still granite and crystalline slates. The whole of the northern face of the system is furrowed by mountain torrents, which make their way to the sea from the heights above by means of steep cascades. The waters rush along at the bottom of rocky troughs, 1600 feet deep, between smooth perpendicular walls and over many blocks of micaceous stone. The broken cascades, seen from a distance out at sea, have the appearance of snow, and thus, by suggesting a great height of mountain above the snow-line, strengthen the illusion that the Santa Marta Mountains have a much greater altitude than that which in reality they can lay claim to.

HYDROGRAPHY.—The hydrographical centre of the system is identical with the orographical—the central snowy chain. On the west side of this rises the Cataca, in the bowl or depression between the Kungukaka and the Curucata ranges. On reaching the plains the Cataca is joined on the left hand by the Rio de la Fundacion, whose head-waters lie amidst the south-western spurs around San Sebastian. Further north, on the same face of the system, rise the various feeders of the Rio Frio, which, together with the Cataca, pour their waters into the Ciénaga Grande, an extensive lagoon intervening between the mouth of the Magdalena and the Sierra Nevada, and fenced off from the sea by the long narrow sand-spit, called the Isle of Salamanca, which lies athwart its entrance. To enumerate the numerous torrents which seam the northern slopes would be tedious, and none possess sufficient importance in themselves to justify a separate mention. Nearly all have their sources high up in the snowy fields of the central chain. It only remains to notice the Rio Rancheria and the Rio Cesar, with the tributaries of the latter.

The Rio Rancheria takes its rise to the east of the central snowy mass, flows eastward between the bifurcating ranges of its eastern extension, then south-eastwards as far as Fonseca, where it bends towards the east, then towards the north-east, passing between the Sierra Nevada and the Cordillera, as already stated, and finally curves round so as to reach the Caribbean Sea a little to the east of the town of Rio Hacha. At its mouth it changes its name to Rio Calancala. The Rio Rancheria receives two or three unimportant tributaries on its left.

The sources of the Rio Cesar are contained in the granitic centre of the system, but are situated not higher than 3000 feet above the sea.

Before reaching the long valley which parts the base of the Nevada from that of the Cordillera, the river traverses the Sierrita. But during this part of its course its volume is exceedingly small; in fact, during the dry season its bed dries up altogether for a length of 25 miles, from San Juan, where it turns south-westwards along the valley, to the point where it is joined by its right-hand tributary, the Badillo. The same fate overtakes the left-hand affluents which reach it in this the upper part of its course. None of the streams, however, which drain the western slopes of the Sierra de Perija are at all long, and consequently they at no time augment the volume of the Rio Cesar to any considerable extent. But with three of its right-hand tributaries—the Badillo, the Guatapuri, and the Ariguani—the case is quite different. The first-named brings down a considerable body of water, which, on being poured into the bed of the Rio Cesar, first entitles it to be called a river. The Guatapuri, a few miles lower down, has a less volume of water, but is very impetuous, and is liable to rise suddenly and overflow its banks. By this addition the Rio Cesar becomes 300 yards wide—the same width it had at San Juan, but is much deeper. Some distance below this confluence the Rio Cesar has deserted its old bed, and now flows in a new one more to the south-east. Here also it divides into two branches, forming an island some 15 miles long. The north-western branch, which is broad and shallow, is the real river; the south-eastern is narrow and deep, and was constructed artificially by a Colombian, who caused the waters of the main river to turn aside for the purpose of irrigating his farm. The original bed of the Rio Cesar is now occupied by an affluent called the Rio Guaimaral, which catches up the numerous streams that come down from the south-eastern slopes of the Sierra Nevada. The Rio Ariguani springs from the Chinchicua range, at a height of about 11,000 feet; it then skirts the south-western spur of the Nevada—the Alta de las Minas—and after traversing the swampy savannahs that fill up the angle between the Magdalena and the Cesar, joins the latter a short distance above its entrance into the Laguna de Zapatosa. The waters of the Rio Cesar, flowing almost due south, meet the stronger current of the Magdalena, which flows north, and consequently are driven back upon themselves; the backwater thus caused overflows into the natural reservoir mentioned, the Zapatosa Lagoon.

In connection with the Cesar and the Rancheria, Mr. Simons is inclined to believe that in former times the Rio Magdalena may have utilised their common valley as a channel to the sea, finding its outlet to the east of the Sierra Nevada, either at Rio Hacha or in the Gulf of Maracaybo. The ten or twelve miles which separate the two rivers is a level plain. The difference of elevation between Fonseca on the Rancheria and San Juan on the Cesar, on the one hand, and El Banco, at the confluence of the latter river with the Magdalena, on the other, is at the present time only 450 feet. A slight rise of the ground on the east, at the foot of the Andes, would easily account for the present northerly

course of the Magdalena. If this theory is sound—and it has the support of M. Elisée Réclus also—the Goajira Peninsula would be the alluvial delta of some former large river which found its way along the western foot of the Andean Cordillera, separating it from the Santa Marta system on the north-west.

CLIMATIC RELATIONS, VEGETATION, CULTIVATION.—Notwithstanding the short distance between them, the northern and the southern slopes of the Santa Marta Mountains differ as widely as possible. Whereas the former are densely wooded, being covered from 4000 feet downwards to the sea-coast with virgin forests of true tropical luxuriance and moistness, the latter, above 6300 feet, are nothing but naked rocks. This difference depends upon climatic conditions. During the greater part of the year the north-east trade-wind strikes against the northern slopes, causing a heavy precipitation; moreover, during the rainy season, which lasts from August till the end of October, and does not entirely give way to the dry season until the end of December, the same side of the mountains is kept wrapped in dense mists by the prevalent winds, which blow from the west and north-west. There is also a second rainy season, lasting from the middle of April to the end of May or beginning of June. At these times the mountain torrents become gorged, and pour down immense quantities of water upon the narrow fringe of low ground which skirts the sea, inundating the entire stretch between the towns of Santa Marta and Rio Hacha. Consequently this region is then no longer passable, being converted into a red, greasy, loamy soil or grey sandy detritus. It gives off malarious effluvia, and becomes a breeding-place for swarms of insect pests—mosquitoes, ants (black, white, red, yellow, some of hideous size), stinging flies (*zancudos*), sand fleas (*niguas*), and various larval monsters of microscopical size.

On the southern slopes, whilst the mountains above 6300 feet are quite destitute of forest, below that line they are covered with vegetation. This fact, that the upper margin of the zone of forests comes so low down, is peculiarly characteristic of the Sierra Nevada; for both in the mountains which occur in Venezuela and in those which belong to the Colombian province of Santander, as well as on the Sierra de Perija, the superior forest margin lies at an altitude of about 8200 feet. And this is not the only botanical peculiarity of the Santa Marta Mountains. At an altitude of 9200-10,200 feet the Andes rose (*Befaria*) grows in tree form, 13 feet high; here also a species of *Espeletia* (called by the Arhuacos *Freilijon*) is found in tree form at an altitude of 8200 feet. Neither of these plants occurs in tree form anywhere else in Venezuela and Colombia; there the former is always a shrub, and the latter a low plant. In the Nevada the Indians cultivate the coca—a fact which is the more remarkable since its proper habitat lies far to the south, whilst in the intervening countries, as well as in Venezuela, it does not occur at all.

The valley of the Rio Cesar is, however, in respect of cultivation, the most important region of the State of Magdalena. The only exception to the general fertility is the region about San Juan, in the upper and narrower part of the Rio Cesar basin. There it is hot and arid, and the soil is consequently barren, producing nothing but cacti, with nut-trees, brazil-wood, sassafras, etc. The chief products are coffee and sugar, which are grown on the lower slopes of the hills on both sides of the valley. Higher up, on the Cerro Pintado and the Sierra de Perija, the forests are rich in cinchona bark and india-rubber. The Rio Cesar, after receiving the Guatapuri, flows through a forest tract of cedar, brazil-wood, and *lignum vitæ*; and from the same point its valley begins to widen out into expansive savannahs, which at certain portions of the year support great herds of cattle. During the dry season of summer the herds are driven down to the fresher herbage that grows on what at other times are marshes, islands, and lagoons situated along the course of the main river and its tributaries. Below the confluence of the Araguani with the Cesar the low-lying marsh-lands are utilised for the cultivation of great quantities of Indian corn.

The country that skirts the western spurs of the Sierra Nevada, from beyond Alta de las Minas northwards to the river Cataca, is almost entirely uninhabited and uncultivated, being occupied by dense virgin forests. But still further north, between the Cataca and the old town of Santa Marta (founded in 1525 by Rodrigo Bastidas), numerous settlements are said to be springing up, chiefly for the cultivation of tobacco, cacao, Indian corn, and plantains.

In the districts around the head-waters of the Rancheria, on the east of the Sierra Nevada, cattle-rearing and cattle-feeding again form the chief occupations of the inhabitants; and a little trade is done in brazil-wood and horses.

In respect of mineral wealth, copper is reported to be abundant on the banks of the Sevilla, a tributary of the Rio Frio, on the west; about the Alta de las Minas, and at other places among the south-western spurs and outliers of the system; also at Espiritu Santo, between the Sierra de Perija and the Rio Cesar. Gold is found in the Rio Dibulla on the north; in the Rio Sevilla; and at one or two other isolated points. Deposits of coal occur sporadically at various places in the valley of the Rio Cesar, especially at Espiritu Santo.

POPULATION.—The population fall into three categories:—(1) Colombians, the offspring of old Spanish fused with Indian blood; (2) the Arhuacos; and (3) the Motilones.

(1) The Colombians constitute the only really civilised element in the population; they are the cattle-breeders, the coffee and sugar planters, who make the Rio Cesar valley the most fruitful part of the entire State of Magdalena. Formerly, they were in a much more prosperous condition than they are nowadays; but the bad political administration, and the

many political revolutions and disorders, particularly that of 1860, from which the States of Colombia have suffered, have nearly ruined the once flourishing towns of the Rio Cesar valley. But many of these, notwithstanding the want of good means of communication, are now beginning to revive, and their inhabitants are turning their attention to fresh objects of culture, such as coffee, sugar, cinchona, etc.

(2) The Motilones, who are estimated to number about 3500, inhabit a "reserve territory," the centre of which is the decayed town of Espiritu Santo, at the western foot of the Sierra de Perija. In spite of the efforts of the Colombian central Government for their civilisation, they still maintain themselves in a condition of semi-independence, and often occasion much trouble to the more peaceful settlers in their vicinity.

(3) The Arhuacos, who dwell on the Sierra Nevada, and who therefore are a race of mountaineers, are fast submitting to the influences of civilisation; most of the younger men can now read and write Spanish. This people, who number about 3700, are peaceful and agricultural, and live almost entirely upon vegetable food. As a race they are idle, and somewhat lethargic, both physically and mentally. Their principal occupations are the rearing of cattle, the making of nets, hammocks, bags, and other receptacles of the fibres of the American agave, which grows, below 6700 feet, in the vicinity of nearly every Arhuaco village. They also possess many coca plantations, which are cultivated for the most part between the limits of 2600 and 5200 feet, though the plant will grow and thrive both at higher and lower levels. The Arhuacos are large eaters, taking a great number of meals a day; they are fond of dancing; and are subject to the influence of sorcerers (*mamas*). The sexes live strictly apart; custom even prescribes that the husband dwell in a separate hut from that which is the home of his wife and children. The male population have a very curious way of chewing the leaves of the coca plant (*Erythroxylon Coca*). Every Arhuaco Indian carries about with him a gourd, shaped like an hour-glass, which contains a mixture of calcined and pulverised roasted sea-shells reduced to a yellowish brown paste. After he has taken the coca leaf into his mouth, he adds to it, by means of a smooth piece of stick, a little of this pasty mixture, and then proceeds to chew the compound.

Dr. Sievers is of opinion that this people are not descended from the original inhabitants of the country, the Taironas, who offered such a stout resistance to the first Spanish arrivals; he regards them rather as the survivals of various races who have been driven back by the Spanish conquerors into the comparatively inaccessible mountainous regions of the Sierra Nevada, and is disposed to take the Goajiras, who lead a nomad existence in the sandy plains of the peninsula bearing that name, for the descendants of the warlike Taironas. The two peoples form in every respect a striking contrast with each other. The Arhuacos are shy, peaceful, almost cowardly, and inhospitable (though formerly this was not the case); they do not carry weapons, and are well clad. The Goajiras always go armed, are remarkable for physical strength, are warlike, extremely

hospitable, and almost destitute of clothing. Whilst the former lead an indolent life amongst the mountains, in dutiful submission to the Colombians, the latter cling with tenacious courage to their independence in the midst of their melancholy and well-nigh impenetrable wastes of sand.

The territories of the Motilones and the Arhuacos, although separated from each other by the valley of the Rio Cesar, form politically the "Territorio Nacional de la Nevada y Motilones," in immediate dependence upon the central Government of Colombia, and are administered by a prefect having his headquarters at Atanquez, a mountain-town situated on the east of the Sierra.

ON REALISTIC AND DRAMATIC METHODS IN TEACHING GEOGRAPHY.

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(CONCLUSION.)

D.—EXAMPLES OF DEMONSTRATIVE AND DRAMATIC METHODS IN TEACHING GEOGRAPHY.

I.—LATITUDE AND LONGITUDE.

1. *The difficulty of describing position on a Globe.*—Use a plain, unmarked sphere—a common ball or orange will do. Mark a cross upon it. Ask the pupils to describe its place. Show the impossibility of doing so, as it is. The cross is neither up nor down, right nor left, north, south, east nor west, top, middle nor bottom—as you have only to change the position of the globe to nullify any description of its place. Thus they vividly realise the difficulty of describing place or locality on an unmarked sphere or globe under non-stationary conditions.

2. *Fixing Polar Points.*—Make it revolve. At once, we have two fixed points—the ends of the axis (or axle) of rotation. These are called poles—which can be indicated by means of a wire run through the orange, round which it is made to turn. Care should be taken to see that they truly understand the realities as to axis and poles, and to discriminate between this use of the word "pole" and the common one—a most frequent source of error, or at least bad association, in young minds. Utilise its derivation, from *πόλος*, a point, *πέλειν*, to move, akin to *κέλλειν*, to drive. These points are called north and south poles: either being either; but one being selected as north. We can now state the distance of our cross from either pole.

3. *Drawing an Equator.*—To help us to measure the distance from the poles found, we draw a line round the globe equally distant from the

poles, in the direction of the rotation. This is called an equator, or equal divider. We can now say more readily whether the cross is half-way between the poles, or how far it is from this position.

4. *Finding Latitude*.—It will be better, however, to reckon the position of the cross from one thing rather than two—that is, from the equator instead of from either pole. We can thus say how far it is north or south of the equator. This is called latitude, which means distance from the equator.

5. *Parallels of Latitude*.—To enable us to measure latitude accurately, we draw lines at regular distances parallel to the equator. These are parallels of latitude. They tell distance north or south of the equator.

6. *The difficulty of describing position East and West*.—We can now give the distance north or south of the equator, but not the position of the cross east or west. The globe revolves; so that we cannot say it is on the east or on the west side, because the west at once becomes east, and east becomes west. We must, therefore, have, as in latitude, some point, or, better, some line to count from. But latitude is reckoned from a line which was determined for us by its equal distance from the two fixed poles of rotation. In judging as to a place being east and west, we have no fixed point or line. We must, therefore, fix on some one line from which to count.

7. *The need of a first Meridian*.—This line may be any line, as being chosen or arbitrary, in the absence of a natural means of fixing it, as in latitude. Hence different nations have chosen different first lines of reckoning—the British, the great national observatory at Greenwich; the French, Paris; the Americans, Washington; and so on. This line, from pole to pole through this point, is named a *meridian*¹=line of *mid-day*; because all the places along this line have mid-day at the same moment—which show. Distance east or west of this first meridian=longitude or length. Explain that the words “latitude” and “longitude” were so named from the Roman notions of the size of the earth; the world as known to them being *longer* east and west than north and south; hence the one measurement was by length, the other by breadth.

All nations *must* reckon from the *same line* in latitude, that line being fixed in nature. In longitude, they vary, which is a source of difficulty, the one system requiring to be translated into the other. Hence the desirableness of having a *Universal First Meridian*. This is not yet generally agreed on, though the meridian of Ferro Isle has been used. Point it out, and show its centrality.

8. *Meridian Lines*.—As in latitude, we measure longitude by drawing lines or meridians at equal distances on both sides of the first meridian. Show how these all pass through the poles, and why they cannot be called *parallels*, like the latitude lines; as they are not parallel, but narrow or converge to two points through which they pass—the poles.

¹ Corrupted by *d* becoming *r*, from the difficulty of saying *meridian*.

9. *Degrees of measurement.*—The distances on a circle are called *degrees*, because they proceed from each other *gradually*, by *grades* or *degrees*. Show how a circle is divided into *degrees*; that the 360° fixed on is only an arbitrary number, not necessary—for 100 in a decimal system would be better; that this number was chosen from its being one divisible by more numbers without a remainder than any other, that is, by all numbers up to 12, except 7 and 11. Then make the pupils name the number of degrees in a right angle or quarter circle $=90^\circ$; in a semicircle $=180^\circ$, etc.

10. *Degrees on the Globe.*—Apply all this to the globe. Demonstrate how latitude, being from the equator to the two poles, can only be counted by a *quarter* circle or 90° ; and longitude, being east and west of a central north and south line, can be counted by *half* a circle, 180° . Show, also, how the degrees of latitude are always equal, that is, of the same length; and how degrees of longitude must vary continually from the equator to the poles, being, in fact, merely proportional parts, not absolute measurements.

11. *Position on a globe absolutely fixed by latitude and longitude.*—Exhibit these lines on a good globe and on a map of the hemispheres; and show how the exact position of a place is determined by the two together. Give examples and exercises in latitude and longitude, both by finding out places by their means, and by giving a place to find its latitude and longitude.

II.—THE PHENOMENA OF DAY AND NIGHT.

In the absence of an Orrery (some of which, however, are now cheap while effective), use a candle or lamp, or, better, a lamp with a reflector, and a globe. The exposition need not here be complicated by putting the earth at its angle of $23\frac{1}{2}^\circ$; it should be put perpendicular.

1. *Day and Night.*—The lighted half = day; the dark half = night; the part between the two = twilight, that is, the *light between* the *light* of day and the *light* of night. Mark a chalk cross, or fasten a small piece of white paper on the globe, and show how it passes into day and night during its rotation; taking care to move the globe from west to east. Show its position at midday and midnight. Show the place and the manner of sunrise and sunset, the morning and the evening twilights. See that the *real nature* of all these changes is fully understood—that the sun is stationary, and that *we* pass in and out of the light and dark, which are also stationary, as caused by the sun.

2. *Hours moved.*—Put a chalk cross directly under the sun = 12 o'clock or noon.¹ From this one fact, deduce all the other hours, with graduated difficulty—first midnight or 12; then morning and evening at half times; then forenoon and afternoon at quarter times; then any hour. Explain fore- and after-noon; and ante meridian or midday, and post

¹ Explain that *noon* was originally the *ninth* hour, or three o'clock, but that afterwards the Church services, called *nones*, or *noons*, or *nines*, were changed to midday.

meridian ; and their contractions A.M. and P.M. Also explain our system of counting by twelve hours, and the Italian by twenty-four hours ; and our recent attempt to introduce the natural twenty-four hours' reckoning. Give exercises to the pupils, by placing a cross at any position in the circle, and getting them to tell and *prove* the hour ; and *vice versâ*, by naming any hour, and asking them to turn the globe to the requisite position, and to *prove* it.

3. *Degrees moved*.—In like manner, deduce the number of degrees moved through in any given time. The whole circle = 360° = 24 hours. Give numerous exercises in degrees, asking children to tell the number of degrees moved through by you, and *vice versâ*, to turn the globe through any number of degrees you name. Therefore 15° are moved through in one hour. 15° E. of our meridian or noon = one hour earlier or forenoon, or A.M. ; and 15° W. of it = one hour later, or afternoon, or P.M. : and *vice versâ*, giving hour and asking degrees passed. Then 1° of longitude = $\frac{360}{24}$ th part of 24 hours or a day = 4 minutes' time. New York, which is 75° W. long. = $75 \times 4 = 300$ minutes = 5 hours, later than our time. A telegram from Britain arrives five hours earlier than it was sent off.

Give varied exercises in time and place, in latitude and longitude in both ways—the teacher naming time or degrees, and asking results ; and *vice versâ*, till the subject is mastered.

4. *How longitude is found at sea*.—Explain the use of a chronometer which tells Greenwich time. The captain finds when it is noon at ship, and thus obtains the difference from Greenwich in minutes, and 4 minutes = 1° . Hence he deduces his longitude. Explain how he knows when it is east or west longitude. This is the mere application of last paragraph. Give numerous exercises on slates as above.

III.—CIRCLES AND ZONES ON THE GLOBE.

Use a terrestrial globe ; or, better, a plain sphere or large ball, with poles and equator marked on it. Have a small table—best if it is circular ; but other shape will do. In the centre of the table, mark the sun ; a chalk circle with rays is best ; a small round flat stone, or other flat ornament, does well. But *do not use another globe or large object for the sun*, as its size and height will confuse the demonstrations. The flat table represents the plane of the earth's orbit, with the sun in the middle ; the sun can, at present, be marked in the centre, and the ellipticity of the orbit may be left out.

1. *If the earth stood vertical before the sun*, show the effects : (1) day and night equal all over the world ; (2) the sun would always shine above the equator ; therefore, no variety of climate except that caused by latitude—that is, there would only be the gradual diminution of heat from torrid to frigid ; (3) there would be no seasons.

2. *The earth's inclination and the Pole Star*.—Hold the globe at an angle of $23\frac{1}{2}^{\circ}$. Be careful to explain that *the axis always points in the one absolute direction* : which may be represented by an object at one end of the room,

so that the axis is always parallel to the two sides of the room. Show that this point in the heavens is practically the pole star—with reason of its name; and the effect of this, that in the rotation of the earth, the whole of the other stars seem to whirl round this one star, which seems to remain stationary; but that this is only apparent, the heavens no more turning round than the room does while the globe is whirled. Prove this by making a cross on the globe, and showing how the objects in the room, while stationary, are seen at different angles all round the circle, as the globe turns. This should be carefully demonstrated, as misconceptions are otherwise certain.

3. *The earth's inclination and the Tropics*.—Incline the globe at $23\frac{1}{2}^{\circ}$, and prove the results by moving it round the table, noting at each point the part of the globe above which the sun is vertical. This is done by holding the globe so as to touch the edge of the table, the surface of the table showing, by where it touches the globe, the direction of the sun's rays at each point thus touched. Start with the part of the table where the edge touches the equator, at the spring equinox, and move from west to east. Note, specially at present, only the four quadrant points, and mark where the edge of the table touches the globe at each of these points.

(1.) Start, therefore, at the left-hand side of the table, looking to the assumed pole star in the room, as settled on. There the sun's rays touch the equator. This gives rise to the *equinox*, or time of *equal night*, all over the world. Prove this fact by whirling the globe and marking crosses at different latitudes, and noting the length of the day at each. (2.) Move to the south side of the table, and show by where the table edge touches the globe, that the sun now shines directly on the earth $23\frac{1}{2}^{\circ}$ N. of the equator; and that as the earth moves from this point, the sun's direct rays fall nearer the equator. This *turning* point is called the *Tropic*¹—that of *Cancer*, from the sun then appearing in the star group called *Cancer*, the crab.² (3.) Move to the right-hand or east side of the table where the edge of the table touches the equator again = *Equinox*. Call the equinoxes the first and second till the seasons are taught. (4.) Move to the north side of the table where the edge of the table touches $23\frac{1}{2}^{\circ}$ S. of the equator, and from this moves nearer to equator again. This is another turning or *Tropic* point, that of *Capricorn*; so called from the sun appearing in the star group of the *Horned Goat* or *Caperer*. (5.) Move onwards to our starting-point, where the sun is again above the equator.

Thus we prove the part of the earth upon which the sun shines directly down during the year, and the position of the tropics = $23\frac{1}{2}^{\circ}$ north and south of the equator—the whole being caused by the number of the degrees of the earth's angle of inclination. Draw circles representing these tropics, and name them.

¹ From $\tau\rho\acute{\epsilon}\pi\omega$, to turn, connected with *torqueo*, to turn or twist; *trope*, a turn or figure of speech.

² Connect etymologically with the disease *cancer*, which is so called from its having a centre and branches round, like a *crab* and its toes.

4. *The earth's inclination and the Polar Circles.*—Move the globe round the table in the same way, stopping specially at the same quadrant positions, and noting the circle of twilight between day and night. If the teacher does not possess or does not use a terrestrial globe, this twilight circle may be well represented by a large sheet of paper, having a circle cut out of it the size of the globe used; the globe being placed inside this circle, the paper is held vertically to represent the twilight circle, but care should be taken to hold it always at right angles to the sun. The phenomena now to be examined are those at the two poles. (1.) At the first equinox, the daylight falls equally all over the globe from pole to pole. (2.) From this point to the Tropic of Cancer position, the twilight circle between day and night has gradually moved away from the North Pole till it reaches $23\frac{1}{2}^{\circ}$ from it, and then begins to approach it. Hence the position of the north polar circle, $23\frac{1}{2}^{\circ}$ from the pole, called the *Arctic Circle*, from the star group of the Bear or *Arctos*,¹ or the *Ursine* group. (3.) From this point, it gradually approaches the pole again till it reaches it at the second equinox. Show how this circle is and must be distant from the North Pole the same number of degrees as the tropics from the equator, both arising from the same cause, the earth's inclination. (4.) Give a similar proof regarding the South Pole, demonstrating the position of the Antarctic Circle. This is easily shown by means of the same perforated paper representing the twilight circle, during the rest of the revolution round the sun.

4. *The Zones on the globe.*—These follow as corollaries from the above. (1) The part of the earth over which the sun shines vertically is, of course, that between the tropics. Its breadth = $23\frac{1}{2}^{\circ} + 23\frac{1}{2}^{\circ} = 47^{\circ}$. This runs like a *belt*, or *girdle* or *zone*, round the *middle* of the earth, called *Torrid* or *toasted* or *hot*. (2.) The parts next the poles = $23\frac{1}{2}^{\circ}$ in breadth, or, as in the Torrid Zone, 47° from side to side—erroneously called a *zone* or *belt*, being really a complete circle—the *Frigid*, or *freezing zone*. (3.) The part between the Frigid and Torrid Zones, standing in climate between the one and the other, is the *Temperate Zone*. Its breadth = 90° minus $23\frac{1}{2}^{\circ} + 23\frac{1}{2}^{\circ}$ or $47^{\circ} = 43^{\circ}$. (4.) There are five zones on the globe: one torrid, two temperate, and two frigid; but really six, as the Torrid Zone is, in truth, two zones touching each other; so that we have three zones north of the equator and three south.

IV.—SEASONS AND MONTHS.

A.—*With table and globe.*—Use the same table and globe in the same way, as this subject is but a sequel to the foregoing. Mark a chalk cross clearly on the position of Great Britain, or paste a white or red paper on it.

(1.) Place the earth at the position of the first equinox. There day

¹ ἀρκτος, a bear, connected with Latin *ursus*, a bear.

and night are equal all over the globe, and the sun above the equator, making the climate in Britain neither hot nor cold. This is 21st of March, called the *Spring Equinox*. (2.) Move the globe round to the position of the Tropic of Cancer. The sun gradually moves north till it reaches the tropic. Climate of Britain gradually warmer=summer. Northmost point of sun=*Solstice*, or *Solar Stand*, from the sun apparently stopping stationary for a little before turning south again. This occurs at one-fourth of the circle onwards, in of course one-fourth of the year, or three months more = 21st of *June*. (Though not quite accurate, it is sufficiently so for our present purpose to keep to the 21st of the months all through.) (3.) Move the table round towards the second equinox. The sun gradually moves towards the equator again, till it reaches the *Autumn Equinox*=21st of the third month forward=21st of September. (4.) Move onwards towards the position of the Tropic of Capricorn. The sun now gradually moves south of the equator, and the British climate gets colder till the sun reaches its southmost point, the Tropic of Capricorn=*Winter Solstice*=21st of December. (5.) Move round to the starting-point. The British climate gradually gets warmer as the sun wears towards the equator, at the Spring Equinox. (6.) We thus have four seasons corresponding to the quadrant or quarter positions of the sun above the earth in the tropics, during the *yearly circuit* or *annual revolution* of the earth round the sun. Note that the four positions in March, June, September, and December are the *central* places of each of the seasons; and thus roughly each season consists of each of these months, with a month on each side of it. Thus Spring=the month of March and those of February and April on each side of it, when the sun is on the equator and a month north and south of it; and so with the other seasons. (7.) Ask the pupils to point out the spaces on the table corresponding to each of the seasons. Draw four quadrant lines from the sun to the circumference of the table showing these, and mark also on the table the points of the equinoxes and the solstices, the lines drawn being half-way between these points. (8.) Deduce the *place* of each of the *months* from the foregoing for all the year—from these four quarter positions of the sun, with a month on each side of them=12 months. Get the pupils to put the globe in its right place for any month, and to *prove it*, from reference to the equinoctial and solstitial points.

B.—*Without the table or globe*.—Draw a white circle on the floor for the sun, with a circle round it for the earth's path or orbit. Fix the four great quadrant points of equinoxes and solstices, and mark them on the floor. Ask the pupils individually to stand at the right place for any month, and *prove its* correctness; and to walk or stretch over the space for any season. Let the teacher stand also at any part of the circle, and ask, conversely, the month and the season represented. Ask the pupils in succession to stand at the places of the months till the whole twelve are filled. Ask them then in succession, but irregularly, to take the position of any month, and then to return to their places in the class, and so on in

great variety. The interest of a game—the game of the Months and Seasons—may be given to such lessons and exercises.¹

C.—Go over the same demonstration and exercises *regarding the Southern Hemisphere*, selecting Australia or New Zealand as the place of observation, and give similar exercises with and without the table and globe.

V.—THE VARIATION OF DAY AND NIGHT.

Use a candle—or, better, a strong lamp (with a reflector, if possible), casting a decided shadow—for the sun, and the same globe; the table is not required here. Place the lamp on the floor, or on a small stand high enough to light the globe, so as to be easily seen. Draw a circle on the floor for the earth's orbit. Make the globe rotate while traversing the orbit, and slope it at $23\frac{1}{2}^{\circ}$, keeping its axis, as before, pointing to the same part of the room. In the lesson on Britain, mark its position with white or red paper.

A.—*Regarding Great Britain*.—(1.) Place the globe at 21st March, as before. Show how day and night are equal all over the world, by means of the illuminated half of the globe as it revolves. Hence the *Spring Equinox* or *equal-night* period. (2.) Move the globe towards June. Show how the day gets longer and the night shorter, till June 21st is reached. (3.) Move on towards September. Prove the longest day; then the gradual shortening of the day and lengthening of the night, till they are again equal at 21st September—the *Autumn Equinox*. (4.) Move on towards December. Show the gradual shortening of the day under twelve hours and the lengthening of the night over twelve hours, till 21st December is reached. (5.) Demonstrate this to be the shortest day. Move on towards March again, and show the gradual lengthening of the day and shortening of the night till they are once more equal. (6.) All this should be *exhibited to the eye*, not merely stated or questioned on, and should be shown by repeated revolutions till it is firmly apprehended. (7.) Traverse the same ground, estimating the number of hours at each station of the equinoxes and solstices, in light and dark.

B.—*Regarding the Southern Hemisphere*.—Paste paper on—say, New Zealand, and evolve the phenomena as exhibited there, in like manner.

C.—*Regarding the Arctic Regions*.—Paste white paper over these, and note and mark with pencil the movement of the twilight circle on it as the globe rotates and is revolved round the year circle. Start with the Spring Equinox, and its equal day and night at the poles, as well as all over the world. Then watch and show the gradual effulgence of the polar regions in the light, till the day has no night at all at the Summer Solstice; then the gradual extension of the night till it equals the day again at the Autumn Equinox; then the gradual immersion of the Arctic

¹ Effective and practical methods of exposition, very well illustrated, will be found in Professor Grove's admirable little *Primer of Astronomy* (Macmillan). These only take more trouble and cannot be acted by the pupils like the above.

regions in the shadow, till there is no day there at the Winter Solstice ; and then the gradual growth of day, till once more it is twelve hours long at the Spring Equinox.

Well shown to the eye, this may be made a beautiful and effective demonstration of these phenomena, so difficult for a child unaided to conceive, and so often misunderstood even by adults. The subject requires rigorous questioning before it is fully comprehended, but it deserves and rewards it.

D.—Do the same with the Antarctic regions. The phenomena are easily gone over, if the above are conquered.

VI.—THE PHASES OF THE MOON, AND ECLIPSES.

1. By means of a lamp for the sun, especially with a good reflector, casting a definite shadow ; a globe for the earth ; and a smaller globe for the moon—the various phases may not only be explained, but made clear to the eye. Nothing should be told, but all should be deduced and demonstrated. 2. By the same means, the *eclipses* can be explained. *The Eclipse of the Moon* may be shown to the eye, especially with a reflector, which casts a good shadow behind the earth. The immersion of the moon in the shadow can be observed, and if the globe is of the right size, partial, total, and annular eclipses may be formed and shown. 3. When this is understood, very good exercises on the phenomena may be given by using a stationary globe for the sun, and the boys themselves for the earth and moon, one representing the earth, and another the moon. You ask the earth to stand in a certain position, and then the moon to place himself in any required phase, and to prove that he is right or wrong. In this exercise, use a succession of boys, rewarding any one who corrects an error made, by allowing him to come to the floor. This becomes a pleasant and instructive game of the Moon Phases.

E.—SOME GENERAL PRINCIPLES IN THE REALISTIC TEACHING OF GEOGRAPHY.

1. *Subordinate mere Verbal Memory, and use the other faculties as much as possible.*—Though already urged, this cannot be urged sufficiently. Bring as many of the other faculties to your aid as you can, at every moment—the senses especially ; the all-potent eye, to perceive ; reasoning, to get at the facts from their causes, and lead to their effects ; imagination, to picture the scenes ; and so on—illuminating all by concentrated lights shed by all the faculties.

2. *Fasten the facts to the mind by rousing interest in them.*—Interest, especially in a child, is to the mind what appetite is to the body. If you do not rouse the mental appetite while communicating facts, you do as much cruel harm as if you forced a child to eat without his being hungry. Interest may be roused in a hundred ways, by pictures, dramatic demonstrations, illustrations, reasonings, descriptions, stories, and the like. But it must be created, or drudgery and dullness ensue, with their

unhappy and disappointing consequences. If there is any name on which no point of interest can be hung, leave it out. If there is no fact worth knowing about it, the name is not worth learning.

3. *Use reasoning in all possible cases.*—This can be done much more frequently than is generally thought, especially by those who have not tried it. In fact, Geography may be made highly intellectual training. This is all the higher if general principles are carefully explained, and all cases referred back to these; and in this subject, general principles regarding the globe, and the laws that govern its movements, structure, and productions, are unusually clear, interesting, and all embracing; and are easily capable of constant application to particular cases. Rightly taught, Geography—at present the most mechanical of school lessons—may be made, in skilled hands, less mechanical than most subjects.

4. *Present nothing as an isolated fact, but only in its vital relations to other facts;* and these, if possible, greater and inclusive facts. This is a corollary from the foregoing, this relationship being obtained mostly by reasoning towards it. A bald, isolated fact is not worth knowing. Rightly viewed, no fact is thus isolated, though often the connection with general principles may not be readily perceived. Where it is not, the pupil should not be harassed with such matters. It follows that the number of such barren facts will be greater with some teachers than with others; the skilled educator discovering and being capable of leading his pupils to discover relative facts and principles where another would perceive none.

In the teaching of Mr. St. Clair, this reference to general principles was constantly employed with remarkable effect. In his higher classes, he would challenge auditors to point to any part of the globe. His scholars would then be able to describe its scenery, productions, peoples, winds, etc. etc., and to prove each statement by such reasoned reference to principles. This can be done much more easily than may appear, and, when done, it is peculiarly pleasurable to both teacher and taught, while surprising and gratifying to onlookers.

5. *Select the statistics used, and employ all statistics sparingly.*—Instead of making these the staple work of the class, they should be few, and mainly given as illustrating principles. The aim of the teacher, in regard to statistics, is more to guide the pupil where and how to find them in after life when required, than at present, to burden his memory with their heavy and barren weight. This is all the more necessary in a subject in which statistics are so fluctuating in most of its departments. The present over-statistical grind of the subject is torturing and depressing, and utterly destructive of vitality, intelligence, and interest. Its evils were lately very well presented and satirised by Professor Meiklejohn in his pungent lecture on the "Worst Method of Teaching Geography."

But certain statistics are necessary. What, then, are the principles of selection, both as to amount and kind? (1.) *Give only the chiefest facts minutely as to figures*—the highest mountains, longest rivers, largest towns,

and so on. But let these be as few as you can manage with. (2.) *Select the less important statistics, and give them only approximately, in round numbers; but these still fewer than the former.* (3.) *Give all statistics by reference to proportionate parts in fractions or multiples of a well-known unit—*rivers, by reference to the Tay or the Clyde in Scotland, the Thames in England, the Rhine in Europe, and so on; towns, by reference to Edinburgh and Glasgow in Scotland, Paris in Europe, etc.; mountains, by reference to Ben Nevis, Mont Blanc, etc.; seas, by reference to the Mediterranean, etc.; lakes, by reference to Leman; and the like. Of course, this continual reference to a known quantity is the only sound teaching of dimension in any form or subject.

6. *Present and examine, where possible, the real objects spoken of—*plants, productions, minerals, etc. Hence the need of a museum in all schools—well chosen, however, for real practical teaching, and not a heterogeneous collection of curiosities. Cabinets of such objects can now be had cheap and good. In most cases, these are never used beyond the Infant-room, and in formal object lessons. No object should be spoken of without being at once shown, examined, and conquered, if at all available. In this connection, it is most desirable, in all large schools, especially in great cities, that a complete list of such apparatus in objects, pictures, and maps should be drawn up, with the name of each room in which they are kept; and this list should be hung in some prominent and convenient place, for reference by the staff; and this not for Geography alone, but for all subjects requiring such illustration.

7. *Vivify description by means of pictures, where available—*of scenes, animals, peoples, etc. It saves a deal of trouble, to put it on its lowest level. But how vivid, clear, correct, and, in a word, how real, next to the object itself! But even where the thing can be exhibited, that exhibition is often imperfect. For instance, in showing teak wood, present also a picture of the tree, and, still better, with its native scenery. Materials for this purpose are now abundant, good, and beautiful. Many recent Geographical Reading Books are a very good departure in this direction. But do more than exhibit a picture; question on it till it is fully and clearly understood.

8. *Brighten and illustrate by stories and readings—*from works of travel, adventure, history, biography, and the like. The good teacher utilises a library for his pupils, and makes the old dry bones in this valley of lamentation to live, and this ancient educational desert to blossom as the rose.

9. *Utilise the etymology of place-names as much as possible.*—These are often either remarkably descriptive or historically important, and cast interesting side-lights on drier matters. Illustrations are superabundant: Baltic, the sea of the Belts that gave entrance to it; Minch, Gaelic for a sleeve, from its shape—the same word taking, in French, the form La Manche, the Channel; Uisge = whisky, Celtic for water, becoming Esk, Usk, Ouse, Wash, Isis, Use, Ux. Exe, Ax, Ox, as in Oxford, etc.;

Avon, a stream, appearing alone as Evan, An, Wan, Aisne, Inn, Inney, Aney, Seine, Vienne, Almond, etc.; and compounded, in Doon, Devon, Kelvin, Annan, Leithen, Irvine, Earn, Boyne, Avignon, Verona, Amiens; and so on in innumerable and bright variety and picturesqueness, as in Snaehatten, the mountain with the snow hat. Beware, however, of apparent but wrong derivations. Woolwich is not the wool town, but the hill town; Carisbrooke has no connection with a brook, but with burg; and the like. The best guide, safe, handy, and cheap, on this subject, is Miss C. Blackie's *Etymological Geography* (Isbister and Co.), Skene and revised by Joyce, with an introduction by her brother, the ex-professor.

In conclusion. In this subject, our central motto should be *Res non verba*—realities not words. From prevalent abuses, this excessive expression of a truth may be accepted, by way of revolt against the tyranny of words. We should teach *both* words and things, with the motto, *Res cum verbis*—things with words; but things, realities, being primary and ever-present. Here, as in all education, we cannot sufficiently act on Rousseau's warning counsel, happily less needed now than in his day, but still clamantly demanding attention—"I can never enough repeat it, that we make words of too much consequence; with our prating modes of teaching, we make nothing but praters."

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

An Ordinary Meeting of the Society was held in the Masonic Hall, on the evening of Thursday, 24th March. Dr. Hugh Cleghorn, Member of Council, presided. A Paper entitled *Bechuanaland, with some remarks on Matabeleland and Mashonaland*, was read by Mr. John Mackenzie, late Deputy-Commissioner of Bechuanaland. On the conclusion of the Paper, Dr. W. G. Black addressed the Society, and Dr. Robert W. Felkin proposed a vote of thanks to the lecturer.

GEOGRAPHICAL NOTES.

EUROPE.

The Universities and the Teaching of Geography.—The Council of the Cambridge Senate have issued a report as to the teaching of Geography at the University. After a conference with the representatives of the Royal Geographical Society, they recommend that the approval of the Senate be given to the delivery in the University in the ensuing academical year of one or more courses of lectures on Geography by lecturers selected by the Royal Geographical Society, that a teacher of Geography be appointed by a committee on which the Royal Geographical Society is represented, and that the Senate accept the proposal of the Royal Geographical Society to award in alternate years an exhibition of £100 or prizes of £50 and £25; that before the end of the Easter

Term, 1888, a University lecturer in Geography be appointed for a period of five years at a stipend of £200 a year, of which sum £50 is to be paid out of the common University fund and £150 by the Royal Geographical Society; the appointment of the lecturer to be made by a joint committee of the representatives of the Royal Geographical Society and of the Council of the Senate, subject to the confirmation of the Senate; the lecturer to submit his scheme of lectures to the committee of management; and power to be given to the Council of the Senate, with the concurrence of the committee of management, to cancel the appointment of the lecturer at any time.

A Readership in Geography will also be established at the University of Oxford.

The late Census in Caucasia.—Our Corresponding Member, Herr von Dingelstedt, writing from Tiflis on 26th January, sends the following communication:—

“Herr N. von Seidlitz, an Honorary Corresponding Member of the Scottish Geographical Society, has forwarded me the following remarks about the late census in Caucasia, undertaken under his supervision at the end of last year for the special purpose of determining the number of males (aged twenty-one) liable to military service. These I have translated from the German:—‘Last year a census was taken in view of the obligatory military service imposed on all males of the age of twenty-one among the Christian population, and of the imposition of a special tax for exemption from this service of the Mussulman population, according to a law recently passed. The Cossacks in the Jerek and Kuban provinces were not subjected to the census, for they are liable to military service on other grounds, nor the civic population of the government of Stavropol, which has been already subjected to obligatory military service according to prior laws. Though all the data obtained by the census were not forthcoming (the work was to be done up to the 1st January), it is already possible to deduce some useful comparisons between the number of the population obtained this time and those collected by the last census but one, now thirteen years ago.

“By the examination of the registers kept in parish churches and mosques in the government of Tiflis, which by the by presents a very considerable topographical and ethnical variety, it was possible to arrive at the conclusion that for the period of five years (1875-1880) the natural average increase of the whole population of all nationalities in this province is equal to 1·5 per cent. per year. This would lead us to expect that during the thirteen years elapsed since the last census the population of Caucasia has increased at about the rate of 20 per cent. In reality, as the numbers obtained at the late census demonstrate, the rate of increase is considerably beyond this in the governments of Baku, Erivan, and Elizabetopol, and only a little less in the governments of Tiflis and Kutaïs. The actual rate of increase in the population for the last thirteen years is as follows:—For the government of Kutaïs, 17 per cent.; in that of Tiflis, 19 per cent. (these governments being the most thickly populated, the reason of the comparatively low rate of increase is sufficiently visible); in that of Baku, 24 per cent.; in that of Erivan, 26 per cent.; and in that of Elizabetopol, 33 per cent. The average increase of all five governments in Transcaucasia is 23 per cent. for thirteen years, or 1·77 per cent. a year, which result must be considered as very satisfactory. What deserves especial notice, and is to be considered as a very gratifying fact, is that this considerable increase in the population falls in a large part to the districts inhabited by

Tartars, whose nationality is so rapidly dwindling away in the Turkish Empire. A more detailed examination of the separate items of the population shows that even in some places, as, for instance, in the government of Erivan, the increase of the Tartar population is more considerable than the corresponding increase of the Christian population. The rate of increase in thirteen years among these two different parts of the population was as follows:—In the district of Nakhitchivan, the Christians (Armenians) have increased 19 per cent., the Tartars 26 per cent.; in the district of Novobajazid the Christians (Armenians and Russians) have increased 35 per cent., and the Tartars 42 per cent.; in the district of Alexandropol the former (Armenians and Greeks) 27 per cent., and the latter (Tartars and Kurds) 32 per cent.

“The last census may be considered generally as a satisfactory one for the results actually obtained as well as for the accuracy of computation. This was the first time that an accurate distinction was made between the different Muhammedan sects. The actual numbers obtained by the late census will be given shortly. The presumable number of the population in Transcaucasia, if an increase of 3 per cent. during the last thirteen years be admitted, will be something like 4,515,155 (including the provinces of Kars and Batum.)”

ASIA.

Japan: Island of Kiu-Shiu.—About 29 miles from the city of Kumamoto, on this island, is an active volcano, called Asoyama, which is remarkable for its conformation. It lies “inside the ancient crater of what must have been once one of the largest volcanoes on our earth.” The plain of this ancient crater is fenced in by a ring-wall of rock from 800 to 1200 feet high, and contains some 100 villages clustered about the foot of the existing mountain. The centre of the plain is traversed by the main highway running from Kumamoto to Oita, a large city on the east coast of Kiu-Shiu.—*Church Missionary Intelligencer*, March 1887.

Cochin China.—In 1884, when the latest census was taken, French Cochin China contained a total population of 1,695,970, of whom 1,523,461 were Annamites, 101,662 Cambodians, 54,691 Chinese, 2,167 French, and 96 other Europeans.—*Le Mouvement Géographique*, 27th February 1887.

Dutch East Indies.—A series of statistical details on the Dutch possessions in the East Indies was communicated in January to *Le Mouvement Géographique* by Colonel Havenga, formerly chief of the Topographical Bureau at Batavia. The following is a detailed list of the several possessions belonging to the Crown of the Netherlands:—

1. Java and its dependencies, the chief of which are Princes Island, the Thousand Isles, the Karimon-Java Islands, Bawean, Sempu, Nusa-Kembangan, the islands of Tinjil and Kalapa. Total area, 48,615 square miles. Divided into twenty-one residencies.
2. Madura and its dependencies, the islands Kangean and Sapudi. Area, 2031 square miles. One residency.
3. Sumatra. On this island the Netherlands possess:—(a) Atjeh, with the islands Bras, Wai, Babi, and Tapah. Area, 18,636 square miles. Forms a government. (b) The West Coast, with the islands Banjak, Nias, Batu, and the Mentawai and Nassau groups. Area, 46,565 square miles. One government, divided into three residencies. (c) Bencoolen and Engano (island). Area, 9641 square miles. One residency. (d) The Lampong Districts, including the islands of Tabuan, Lagundi, Sebuku,

Sebesi, and Krakatoa. Area, 10,051 square miles. One residency. (e) Palembang and Jambi. Area, 54,136 square miles. One residency. (f) Riouw and its Dependencies, of which the principal are—Bintang or Riouw, Battam, Kundur, Bakong, Lingga, Singkep, and the island clusters of Tambelan, Anamba, Natuna, and Serassan. Area, 17,466 square miles. One residency. (g) The East Coast, with its dependencies, the islands Rupert, Bengkalis, Padang, Rautan, and Medang. Area, 16,264 square miles. One residency.

4. Banca and its dependencies, the chief being the islands of Lepar, Leat, and Gaspar. Area, 5015 square miles. One residency.
5. Billiton and the surrounding islands—Nangka, Mendanau, Maser, etc. Area, 2508 square miles. One residency.
6. Borneo, with the islands depending upon it, viz.—Karimata, Laut, Pomaran, Sabatia, Nanokan, etc. Area, 198,348 square miles. Two residences.
7. Celebes, constituting three divisions. (a) The island of Celebes, with its dependencies and islands, viz., Saleyer, Kabeina, Muna, Butung, Sumbawa, the western portion of Flores, and the Paternoster and Postillion (Sablaskanak) Archipelagoes. Area, 45,492 square miles. One government. (b) Menado, together with the islands of Sangir, Talauer, and Togean. Area, 26,814 square miles. One residency. (c) Ternate, consisting of the eastern part of Celebes and the islands of Bangai, Manui, and Boboni, its dependencies; also the islands Ternate, Tidore, Halmahera (Jilolo), Morotai, Batchan, the Sula, Obi, Misul, Salwati, Waigiu groups; and the eastern half of New Guinea, with its subsidiary islands, Frederick Henry Island and the Schouten group. Area, 91,828 square miles. One residency.
8. Amboina, with Buru, Ceram, Saparua, Banda Islands, Gorom, Watöbella, Evar, Aru, and the South-Western and South-Eastern Islands. Area, 18,837 square miles. One residency.
9. Timor, consisting of the western part of the island of Timor, the islands of Solor, Alor, the eastern part of Flores, Sumba (Sandalwood), Savu, and Rotti. Area, 22,062 square miles. One residency.
10. Bali and Lombok. Area, 4418 square miles. One residency.

The total area of the Dutch possessions in the East is therefore 639,734 square miles. The total population of the Dutch East Indies amounts to 27,288,362, made up of 26,868,713 natives, 351,252 Chinese, 45,541 Europeans, 15,461 Arabs, and 7395 Hindus, Persians, etc. The Europeans consist of the following:—8600 Dutch, 827 Germans, 249 French, 242 English, 97 Belgians, and 614 of various nationalities, together with 34,912 whites born in the East of European parents. The army and navy are not included in the above figures.

Of telegraph wires Java possesses a total length of 2243 miles; and Sumatra a length of 3472. The first telegraphic message despatched in Java was sent from Batavia to Buitenzorg on 23d October 1856. In the following year fresh lines were laid down, and the whole thrown open to the use of the general public. Batavia was first connected with Singapore by telegraph in 1859.

The first railway line to be constructed in Java was that between Samarang and Surakarta, in 1862, a distance of 124½ miles. The second line, constructed in the following year, joined Batavia and Buitenzorg, 36 miles apart. Besides these, several other lines are now in course of construction, viz., the Batavia-Bekasi (16 miles), the Tagal-Balupulang (15½ miles), the Surabaya-Paseruan-Malang, and the Bandung-Batavia lines. In the eastern half of Java the

Government worked, in 1884, 270 miles of railway, 26½ more being constructed, but not worked. In the western half the railway lines cover 118½ miles, of which 87½ were worked in 1884. Of the line between Jokjokerta and Jilatjap, 119 miles are already laid down. Sumatra possesses but one line actually completed—an "American" line in Atjeh, connecting Oleh-lah and Kota-radja. A second line is in process of construction on the east coast, in Deli; its total length is 34 miles.

AFRICA.

River Mburu.—Lieutenant Wester, who for two years has been in charge of the Stanley Falls Station on the Congo, ascended the river Mburu, by canoe, a distance of two days' journey. This river joins the Congo a little below Stanley Falls, forming a delta, above which it measures 1150 to 1300 feet in width. A short distance higher up, it receives from the left a tributary, bearing the name of Lindi, which is about 660 feet wide, and comes from the north-east. The principal stream, to which the natives give the name of Anciambo, seems to come from the east. At the point where the explorer turned back, its breadth is not less than 800 feet. At two places below that, its course is interrupted by rapids. Lieutenant Wester describes the region traversed as one of great fertility and natural beauty, consisting of forests of magnificent trees and expansive lawn-like tracts, resembling English parks. Elephants are very numerous. The country is inhabited by the Wabeda, who dwell in numerous villages, containing from 2000 to 3000 inhabitants each. Dr. Junker is inclined to identify the Mburu with a river called the Nepoko.—*Le Mouvement Géographique*, 27th February 1887.

Great Namaqua-Land (German).—The German portion of Great Namaqua-Land consists of three sharply differentiated divisions, viz., (1) the Stony Desert; (2) the Sandy Desert; (3) the Valley of the Khuisib.

(1.) The Namieb or Stony Desert is a plain rising rather rapidly towards the interior from Walfish Bay; at a distance of 60 miles inland its altitude above sea-level is 1970 feet. At first sight this desert appears to be bounded by several isolated knots of hills, bare, craggy, and sharply outlined. In reality these are the extremities of various low chains, all having a south-west to north-east strike, with their intervening valleys abutting longitudinally on the principal valleys (Khuisib, Dubas, Tsoaxaub) of the Namieb, which they consequently cross, for these last run in a north-westerly direction towards the Atlantic coast. At the foot of the hills occur groups of rounded, sharply abraded pillars and pyramids, and, in various other parts of the Namieb, masses of highly-polished rounded pebbles and detritus. These characteristics owe their existence to the erosive agency of wind-driven sand-storms, which have both chiselled the outstanding rocks and smoothed and polished the fixed heaps of pebbly detritus scattered over the plain. The remaining portions of the region resemble a whitish yellow or brown concrete, bright and hard, and compounded of pebbles, sand, and fragments of the prevailing rocks, all knit together by saline, calcareous, and gypsiferous clays. After rain this stony ground becomes so soft that persons passing over it sink in up to the ankles. Of course very little, if any, vegetation can grow in such soil. Geologically, the prevailing rocks are gneiss and crystalline slates, with interposed layers of metamorphic limestone and intruded deposits of granite, porphyry, and diabase. The strata are much folded and have a north-east and south-west strike; in the abraded synclinal rifts they frequently appear tilted into the perpendicular.

(2.) Between the Namieb and the sea, and generally parallel to the latter, run a series of high sand dunes. This region is 90 to 120 miles broad between the Garieb and the Khuisib; northwards from the valley of the latter river it gradually diminishes in breadth, approaching Walfish Bay in a long narrow wedge; and still further to the north it diminishes to a narrow girdle from 6 to $2\frac{1}{2}$ miles wide. These dunes seem to be former sand-banks deposited under water along the shore, and to have come into their present position through the elevation of this portion of the Atlantic sea-board. This theory is suggested and supported both by their composition (detritus of the underlying rocks mingled with pebbles) and by their formation. They constitute in the north-east a horizontal plain furrowed by narrow longitudinal, totally enclosed valleys, and in the west two zones, one about 6 miles broad and 656 feet high, the other 4 miles broad and half the altitude of the first. In this latter region greater irregularity prevails in the shape and formation both of valleys and of sand ridges. In shaping these dunes the wind again has played an important part. The prevailing wind comes from the south-west. Consequently the seaward side or west flank of the dunes is sharply profiled and chiselled, and their outlines steadily fixed and constant. On the leeward side, however, things are quite different. There the dunes are covered with loose sand drifts; they form intricate terrace-like steps, complicated with labyrinthine ravines, caldron-shaped depressions, sharp ridges, precipitous side-walls, and sand accumulations of all shapes and forms.

(3.) The valley of the Khuisib is a narrow cañon, some 600 feet deep, ploughed through the rocky soil of the Namieb. Its direction is north-west; and after breaking through the sand dunes in their narrowest part, it reaches the Atlantic in Walfish Bay. For the greater part of its course it has the sandy desert on its right bank and the Namieb on its left. During the greater portion of the year its channel is in many parts dry, or has nothing more than little pools of brackish water; but after a period of rain the river swells to a breadth of 650 to 670 feet, and has a torrent of yellowish water, about $6\frac{1}{2}$ feet deep. The water, however, rapidly disappears again, being partly absorbed by the scanty vegetation, partly lost in the sand, and partly carried off by evaporation. On one occasion, whilst the temperature of the soil of the Namieb was $87^{\circ}8$ Fahr., that of the sand of the river-bed at the same depth was $82^{\circ}4$, and that of the water lying still lower was $75^{\circ}2$. As might be expected, fresh water is not very plentifully scattered over the area of the Namieb.—Dr. F. M. Stapff, in *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* (Bd. xiv., No. 1, 1887).

AMERICA.

Kosmos, the newly established organ of the Geographical Society of the Pacific in San Francisco, contains in its first number an interesting note by Professor George Davidson on the Submarine Valleys of the Pacific Coast of the United States. Three remarkable submarine valleys, which run inshore from beyond the 100-fathom contour line, are described. They occur in the neighbourhood of Cape Mendoceno. At a point where the 100-fathom line lies six or seven miles from shore, off Shelter Cove, in lat. $40^{\circ}1'$, Valley No. 1 breaks in upon it with a depth of 400 fathoms, and brings water of 100 fathoms to within a mile and a quarter of land. The sides of the valley are very steep, and the direction points to a mountain 4,236 feet high situated two and a half miles inland. The second great valley has a depth of 520 fathoms where it breaks through the 100-fathom line, in lat. $40^{\circ}18\frac{1}{2}'$, a little north of Point Gorda. Its walls are very

steep, and the depth of 100 fathoms is carried to within one and a half miles of shore. The third valley is nearer Cape Mendoceno, and, like the others, runs inshore from the west, indenting the 100-fathom line with a trough of 450 fathoms.

The discovery of these remarkable depressions is a matter of great practical importance, since steam-vessels in foggy weather run in towards shore to get soundings, and then continue their course parallel to the coast. A ship was recently lost by running up the axis of one of these valleys, the existence of which was then unsuspected, and only getting soundings when close on the rocks. The physical interest of these valleys is also great, bearing as it does on the problem of the slopes of continents and islands, to which attention has recently been directed by Mr. Buchanan.

Basin of the Orinoco.—*M. Chaffanjon* wrote from San Fernando de Atabapo, on 20th October 1886, to the Minister of Public Instruction for France, reporting the progress made, since the early part of the preceding August, by the French scientific expedition for the exploration of the basin of the Orinoco. The course of that river has been surveyed between the towns of Caicara and San Fernando. Numerous collections—botanical, zoological, ichthyological, and ethnological—have been collected. The basis has been laid for a comparative study of the languages spoken by various Indian races inhabiting those regions, such as the Piaroa, the Guahiro, the Puinabe, the Piapoco. Amongst the most interesting of *M. Chaffanjon's* discoveries may be mentioned two cave catacombs—one in the Cerro de los Muertos, belonging to the Piaroa, and the other in the Cerro Salojito (Arvina cave). The latter was the local position of the heaven of the ancient Imo, a cannibal people exterminated by the Guahiro and Piaroa. The sepulchral urns found in this cave are of peculiar shape, and are ornamented with representations of different species of animals. The explorer announced his intention of continuing his investigations, which were to be directed, in the next instance, to the resolution of the Casiquiare problem and to the sources of the Orinoco itself.

North Brazilian Rivers.—The first number of the 22d volume of the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* contains a brief account, with an excellent map, of the geographical labours of the Frontier Commission appointed by the Governments of Brazil and Venezuela, for the delimitation of the frontier line between those countries, from 59° to 68° W. longitude. Their work falls into three parts—

(1) During the greater part of 1880 the region embracing the upper courses of the Rio Negro and the Orinoco was explored, the work done being mainly hydrographical in character. In this region, the Negro ceases to flow southwards at about the intersection of 67° W. longitude with the equator, and turns almost at right angles towards the east. From a little to the east of 66° W. longitude a complicated series of rivers form a connected line running north almost parallel to the Negro as far as 2° N. latitude, where another river, the Casiquiare, flowing westwards, connects them with the Negro, or, as it is called in this part of its course, the Guainia. The island thus included is called by the Brazilians Pedro II. Island; it is about 160 miles long, from north to south; its breadth in the north is about 30 miles, and in the south, where it attains its maximum, about 75 miles. As already stated, it is bounded on the west and south by the Rio Negro, and on the north by the Casiquiare, a tributary of the Orinoco. The rivers on the east, going north, are:—the Cauabury, Maturaca, Baria, and Pacimoni. The river Cauabury is joined on the west, in 0° 13' 24" N

N. latitude and $66^{\circ} 18' 52'' 50$ W. longitude, by the Rio Ia, which comes from the north-west and has connection with the Rio Dimity, a stream that goes north-westwards to join the Rio Negro; thus Pedro II. Island is divided into two parts. The Dimity, immediately above its confluence with the Ia, is about 400 feet wide. The Cauabury has a rapid current, and flows between steep banks. The Maturaca, after passing between the Serra Onory on its right and the Serra Pirapucu on its left, first receives the dark-coloured waters of an affluent that comes, with a rapid current, from the east, and then it joins the Cauabury. Further northwards, just within the Venezuelan frontier, a series of "bifurcations" take place; in other words, certain rivers divide into two branches, which issue each into a different river system. For instance, the Rio Bahiua, which has its sources in the Serra Imery to the east, splits into two arms, one of which goes, *vid* the Maturaca, to swell the Cauabury, whilst the other joins the Baria, and so the Pacimoni, an affluent of the Casiquiare. There is also in the same neighbourhood a second phenomenon of this kind. A river called the Erubichy, which itself flows into the Baria, sends off an arm to join the Maturaca. Thus the bipartite streams, the Bahiua and the Erubichy (with the Maturaca), anastomose and form an irregular rhombus-shaped island, lying just within the frontier of Venezuela, west of meridian 66° , and south (most of it) of latitude 1° N. The Baria receives on its right the Iatua, a river which rises in the Serra Imery, and has a breadth of 500 to 1000 feet at its confluence with the main stream. The united currents then take the name of Pacimoni. The Casiquiare is in some places more than half-a-mile wide; it likewise is the principal element in another and larger bifurcation, by which the Orinoco is directly connected with the Rio Negro.

(2) The first half of 1882 was occupied with the exploration of two rivers which bear the names Padaury and Marary, and have their sources in the Serra Curupira (not Urucusiro, as is generally given on maps), a range running north-east and south-west between 64° and 65° W. longitude and 1° and 2° N. latitude. The Padaury is a left-hand tributary of the large Rio Preto (a river not shown on any map hitherto), which comes from the north and adds its waters to those of the Rio Negro immediately west of 64° W. longitude. The Marary is a feeder of the Padaury, flows south-east (not south-west), and joins it from the right. It is a narrow torrent, with rapids and steep banks. On the north of the Serra Curupira, where it connects with the Serra Tapiirapeco on the west (not on the east) rises the mountain Guay, around which lie the head-waters of the Castanho, a tributary of the Casiquiare. The Castanho, at this part of its course, flows in a north-eastern direction (not a south-western). In the beginning of April, in the mountains, the thermometer sank to $62^{\circ} 6$ Fahr. at night.

(3) During the autumn of 1882 and the following winter, expeditions were sent to explore the main feeders of the Rio Branco, viz.: the Uraricoera, the Cotingo, and the Mahu. The last two are affluents of the Tacutu, which unites with the Uraricoera in 3° N. latitude, nearly midway between 60° and 61° W. longitude, to form the Branco. The Uraricoera has its origin far to the west, probably in the Serra Pacaraima. At first a mere mountain torrent, it eventually becomes a slow and tranquil current, flowing through the midst of wide savannahs. Its principal tributary is the Uraricapara, which has its sources to the north-west in the Serra Pacaraima, and joins the main stream on the left. In this part of its course the Uraricoera makes a semicircular bend to the north; at the same time it sends off on the right a branch, the Canal do Maraca, which again enters it lower down, thus forming the large island of Maraca. The Cotingo or Cotin comes from the Serra Roraima, and flows almost due south.

The Indians who dwell around its head-waters have come under the influence of England, through Demerara, and are rapidly acquiring the English language. The Mahu is a river of little importance; its breadth at its confluence with the Tacutu is only about 230 yards; higher up it is about 180 yards wide.

The Brazilo-Venezuelan frontier line coincides, roughly speaking, with the mountain chains which form the northern boundary of the basins of these rivers, that is, from the Rio Negro eastwards. A large part of it, extending from the Serra Curupira to the Serra Urutany in 63° W. longitude, at the source of the Rio Uraricapara, could not be explored owing to the impassable nature of the country and the hostility of the natives.

City of Oropesa, Bolivia.—*M. Lucien Raulet*, in a note to the *Bull. de la Soc. de Géog. Comm. de Paris* (t. ix., No. 2, 1886-87), adduces important evidence for the identification of the ancient city of Oropesa with the modern town of Cochabamba. He alleges that the two names have been appropriated and used as the designations of two distinct towns since the beginning of the eighteenth century, the mistake being perpetuated in nearly all dictionaries and encyclopædias of geography which have been published in Europe during that period. He quotes the analogous instance of Sucre, the capital of Bolivia, which has at different times been known as Charcas, Chuquisaca, La Plata; and the evidence of the Bolivians, of the most recent official maps, statistics, and travels, as well as of certain geographers, in support of his contention.

M. de Brettes.—On 19th August 1886, *M. de Brettes* set out from Buenos Ayres to explore the comparatively unknown tract extending between the rivers Bermejo and Pilcomayo. He intended to ascend the Parana-Paraguay as far as Villa Formosa. Then, starting from that town, in company with *M. de Boitiers*, engineer, who is to study the hydrography, and *M. Robin*, he will ascend the Rio Monte-Lindo as far as the point, 45 miles above its confluence with the Paraguay, where it bends south-westwards. Leaving the Monte-Lindo at that point, he will pursue as near as possible a straight line to Tarija in Bolivia, keeping at an equal distance from the Bermejo and the Pilcomayo. He hopes to come into contact with the tribes of the Tobas, who massacred the Crevaux expedition, and to learn something more about that ill-fated enterprise.—*Bull. de la Soc. de Géog. Comm. de Paris*, Tome ix., No. 2, 1886-87.

OCEANIA.

The Tinguianes of the Philippines.—In the *Mittheilungen d. k. k. Geographischen Gesellschaft zu Wien* (Bd. xxx. No. 1), we notice a paper on the Tinguianes, a race of people (probably sprung from Chinese immigrants) dwelling in the provinces of Abra and Ilocos Sur in Luzon, the principal island of the Philippines. The paper consists of two parts: the first is a translation by Professor F. Blumentritt (who has made the study of the geography of the Philippines especially his own), from the Spanish of Don Isabelo de los Reyes, and is to be continued; the second part is cartographical in substance, explaining the map which Professor Blumentritt has prepared to show the geographical position of the Tinguianes.

Mr. H. O. Forbes.—At a meeting of the Melbourne Branch of the Australasian Geographical Society, held on the 17th February, it was announced that the sum of £1000, granted to the Society by Government for the purpose of exploration, would be handed to the Rev. J. Chalmers, towards the expenses of exploration in New Guinea. Members of our Society who have been interested in the work of Mr. H. O. Forbes will regret that the money has not been given

to him to enable him to carry out his ascent of Mount Owen Stanley in the coming season. Mr. Chalmers, however, has many of the qualities necessary to ensure success in an expedition of this kind; and, seeing that he and Mr. Forbes are both good men, personal friends, and incapable of jealousy, and that each is, besides, in certain respects, the complement of the other, it is perhaps not too much to hope that they may unite their resources, and undertake a joint expedition. Such a course would much more than double the chances of success for either of them separately, and their united resources will not err on the side of superfluity.

Discovery of a New Island.—The reported discovery of a new island, north of German New Guinea, by Captain Allison of the *Fei-Lung*, whilst on a voyage from Sydney to Shanghai, has been officially confirmed. The new island is situated at about $1^{\circ} 25'$ S. latitude, and $143^{\circ} 26'$ E. longitude, between the island of Durour and the Exchequer Archipelago. In length it measures about $1\frac{1}{2}$ miles; it rises 100 to 160 feet above the sea, and is completely wooded.

Kaiser Wilhelms-Land (New Guinea).—During the first nineteen days of November 1886, Freiherr von Schleinitz, the Governor of German New Guinea, conducted another reconnaissance voyage, in the *Ottolie*, extending from Fortification Point to the embouchure of the Empress Augusta River; in addition to this coastal journey, he fixed the geographical position of the Purdy Islands, and visited Mioko and Matupi in the Bismarck Archipelago, as well as touched a portion of the south of New Pomerania.

Between Fortification Point and Astrolabe Bay on the north-west, the coast consists of wide bays, penetrating not far inland, and backed by a range of tolerably high hills, the space between which and the sea is filled with their outliers. The main chains run for the most part parallel to the coast, and maintain a pretty even summit-line. Their upper slopes, together with the coastal fringe, are well wooded—but not the middle zones of the hill-slopes; the foot-hills are in many cases covered with grass. This portion of the coast seemed to be well inhabited. East of Astrolabe Bay, from Cape Rigny to the neighbourhood of Constantine Harbour, the hills recede from the sea; but west of the latter, they again send out their outliers, as ribs, close down to the shore, and terminate in the Constantine Range, 650 feet high. The western side of Astrolabe Bay, from this range northwards to the neighbourhood of Friedrich Wilhelm Harbour, the country adjacent to the sea—Maclay's district—is flat and well watered. Owing to these advantages, and the fact that it possesses a rich soil, it seems well adapted for cultivation according to European methods, and it is, moreover, very sparsely peopled. In the north-west corner of the bay, at a short distance from the shore, lie the little islands of Bili-bili, Grönemann (Uranu), Colomb (Jabe), and King (Ken). Between the last-named and the mainland runs a channel 500 yards wide and 10 or 11 fathoms deep. The inhabitants of Bili-bili are expert mariners, and renowned for the making of earthenware vessels. Opposite Grönemann Island, a river (Marie) reaches the sea, which, at its mouth, is 260 to 300 feet wide, and from 5 to 8 feet deep. About a mile and a half above its mouth its depth decreases to between 3 and 7 feet, and its channel is impeded by natural weirs of stones lying athwart its course. Still further up, it becomes a mountain torrent, and flows between banks of alluvial formation, 10 to 13 feet high.

North of Friedrich Wilhelm Harbour the coast is very much broken; a short distance from it, and parallel with its main direction, a string of coral reefs and islands form a safe and spacious outer harbour, within which are several inner

basins, penetrating inland, capable of holding nearly all the navies of Europe. To this complex of protected anchorages the name of Alexis Harbour was restricted. The shores are thickly planted with mangroves. Eight or nine miles inland the Hansemann range sends off a northern continuation, leaving between itself and the sea a stretch of flat land, consisting of volcanic detritus deposited upon an underlying stratum of coralline formation. Midway between Cape Juno and Cape Croisilles, a little to the north of 5° S. lat., the *Ottilie* anchored opposite the Ama River, the mouth of which was closed by a sand-bar, and is from 490 to 590 feet wide, with about 5 feet of water. The soil in the neighbourhood is alluvial. Beyond Cape Croisilles, where the coast-line bends almost due north-west, the *Ottilie* found entrance into another natural harbour (Prince Adalbert Harbour), with 10, 12, and 15 fathoms of water, fenced off from the ocean by reefs and islands. The succeeding stretch of coast, north of Pallas Point (a little to the north of this last harbour), was not surveyed.

The next stop was made at the station on Tchirimotch Island in Hatzfeldt Harbour. The mainland at this point spreads out into a spacious grassy plain, which extends eastward beyond Samoa Point, consisting alternately of grassy and wooded belts; inland this plain is bordered, at a distance of some seven miles, by a wooded chain of hills with a narrow ridge. West of Hatzfeldt Harbour come a series of small bays, penetrating comparatively deep inland, and having their shores planted with cocoa-nut trees. Then the coast-line trends north-westwards, being bordered by very low ranges of grassy hills and gently rolling grass-land, with groups of trees in the lower parts. Somewhat further on the coast breaks again, forming a large bay (Prince Albert Harbour), with the Nielsen Islands lying in the entrance. The bay is divided by a wooded spit and a reef into two basins, each extending about a mile inland. Next come Potsdam Harbour, with small coralline islands and sandy shores, planted with cocoa-nut trees, and thickly studded with native villages; and beyond Potsdam Harbour, a bay to which the name of Hansa was given. This bay forms a good and sheltered anchorage, with 10 fathoms of water at from two to three cables' length from the shore.

Some distance to the north-west of Hansa Bay, the mouth of a large river, 1300 feet wide, was discovered; but, like nearly every river along this coast, it was blocked by a reef. A passage, 13 to 14 feet deep, was, however, found on the west, and inside the bar a depth of 8 or 9 fathoms. The *Ottilie* steamed a distance of some 9 miles up the stream, passing two or three islands, and the mouths of several affluents. At the highest point reached by the vessel, the river—which was named *Ottilie*—had a width of 1600 feet, but was crossed by a sand-bank, above which there was not more than 9 feet of water. Its banks, and the general character of the vegetation (nipa, areca, and sago palms) growing upon them, resemble those of the river Augusta. Between *Ottilie* River and Augusta River the coast-line is broken by a broad salt-water lagoon; its entrance is nearly 1000 feet wide; its breadth inside from east to west averages $\frac{3}{4}$ to 1 mile, and its depth 2 to 3 fathoms. After proceeding some $3\frac{1}{2}$ miles, Freiherr von Schleinitz was unable to detect the end of the lagoon. Its shores are, for the most part, covered with mangrove trees, and on the easterly tongue of land, separating the lagoon from the sea, grow numerous palm-trees, beneath which stand several well-built native villages.

The *Ottilie* then made for the Purdy Islands, which were sighted on the morning of November 10th. These consist of two groups, each containing two larger islands and one of much less dimensions. The westerly group—Bat Islands—are of coralline formation, have a flat surface, are densely wooded (cocoa-nut

trees on the periphery), and are surrounded by coral reefs. They are largely frequented by various species of doves, fowls, sea-gulls, etc. The second group, consisting of Mole Island, Mouse Island, and Elizabeth Island, lie not E. $\frac{1}{4}$ N. from Bat Island, but ESE. $\frac{3}{4}$ E., and consequently some $17\frac{1}{2}$ to $18\frac{1}{2}$ miles more to the east than the position hitherto given them. These islands also harbour many birds. They also possess banyan, palm, cocoa-nut, areca palm, and bread-fruit trees.

Leaving the Purdy Islands, the *Ottilie* made for New Mecklenburg, and reached Blanche Bay, Matupi. On this island an attempt is being made to cultivate cotton, cocoa-nut palms, and coffee, as well as various other tropical fruits. The soil should be excellently adapted for this purpose, consisting of volcanic tuff overlying limestone; it also possesses the property of easily absorbing the moisture, and does not readily part with either by subsuperficial percolation or by evaporation.

Then, after a flying visit to Mioko, the Governor skirted a part of the south coast of New Pomerania. The shores of Gazelle Peninsula, from Cape Gazelle to beyond Cape Palliser, resemble those of Kaiser Wilhelms-Land. The low tract at the foot of the hills is pretty extensive, and is in many places sandy. South of Wide Bay, however, the hills approach nearer to the shore, and assume a table-like appearance, averaging about 300 feet in height. The entire coast lands are well timbered. In the neighbourhood of Points Montague and Beechey the island is formed of tolerably high hills (1300-2000 feet), running diagonally to the axis of the island, and terminating in low passes, between which lie deep bays with islands. The hill ranges rise at a few points into peaks, and are everywhere covered with forests. Their outlines fall away into expansive plateaux of 65 to 100 feet in height.

A third series of observations was made in the neighbourhood of Roebuck Point, where the *Ottilie* was taken into a large bay, the entrance of which, in $6^{\circ} 19' S.$ latitude, is formed by four of an archipelago of small islands. The bay itself has deeper basins on the east (one) and west (two), and measures from north to south $2\frac{3}{4}$ miles, and from east to west $1\frac{3}{4}$ miles. Its western part is crossed by meridian $150^{\circ} E.$ Its shores rise gradually to a plateau in the interior, beyond which was visible, in the far distance, a range of hills with sharp and rugged peaks. The western side of the bay, as well as numerous small islands which stud its waters, is constituted of a series of terraced plateaux, step-like, tier above tier.—*Nachrichten über Kaiser Wilhelms-Land*, Heft ii., 1887.

The same number contains a map, by Captain Dreger, illustrating the reconnaissance labours of Freiherr von Schleinitz and the course of the *Ottilie* along the coast of New Guinea. Appended to the account of that voyage is a description, by Dr. Hollrung, of the flora in the immediate vicinity of Hatzfeldt Harbour.

New Caledonia.—A long and interesting account of the physical features of this island, and of its native inhabitants, the Canaques (*Kanakas*), from the pen of M. Octave Opigez, is contained in the *Bulletin de la Société de Géographie* (Paris), 3^e Trimestre, 1886. Also in the *Bulletin de la Société de Géographie Commerciale du Havre*, November-December 1886, we notice a paper by M. Emile Bied, formerly pupil of the Parisian School of Mines, on the flora, fauna, and especially the mineralogy of the same island. The principal minerals of commercial value are nickel, iron, gold, cobalt, and coal.

The Marshall Islands.—The Marshall Islands, a group which quite recently has come under German protection, form a double chain running S.E. and

N.W., the two parts of which are known respectively as the Ralik and the Radak Islands. Politically, the two chains are distinct. The individual islands are not each governed by one chief, but in many cases are divided among several, whose power and prestige depend not so much on their rank as on the extent of their possessions. The chiefs are divided into three classes, but of these, the lower owe no allegiance to the higher, and Kabua, the present king, is so styled, not as a mark of superior power, but because he and his step-sons are the largest landowners in the group.

The Marshall Islanders, especially those of the Ralik group, are extremely unattractive, ugly in feature, dull in intellect, and filthy in habit. Leprosy and syphilis are unusually prevalent, and ringworm is almost universal. European stuffs are pretty extensively used for dress, both men and women wearing a long tunic and petticoat reaching nearly to the feet. The ancient costume, which consisted chiefly of a sort of mat made from wood-fibres or pandanus leaves, with head and neck ornaments of mussel shells, is, however, by no means rare. According to their rank, the men are more or less tattooed on the back and breast, but this fashion does not extend to the female portion of the population.

The flora and fauna of the Marshall Islands are very limited, and, in consequence, the food of the natives presents but little variety. It consists chiefly of coco-nuts, pandanus and bread-fruit, with fish, and occasionally a little pork. Eggs are never used, though fowls are extensively reared for the benefit of foreign visitors.

The native dwellings are small two-storied structures, 10 or 12 feet square, and so low that one can scarcely stand upright in them. They mostly stand alone, or in little groups of two and three. No buildings exist capable of being used for political or social gatherings, for hospitality is a virtue which the Marshall Islanders have yet to learn. They are skilled oarsmen, and excel in the building of their curiously shaped canoes, one side of which is straight, while the other is highly curved. Of their domestic relations there is but little to tell. Polygamy is the prevalent custom in regard to marriage, each of the chiefs having three or four wives, whose duty it is to attend to the housework. There is no native religion properly so called, but a sort of magic is practised by sorceresses, who profess to pry into the future and to cure disease by means of spells. It is said that the natives believe in a future state, but they worship neither gods nor ancestors. Their spiritual interests are, however, now being cared for by a branch of the Boston Mission Society, whose efforts have already met with considerable success.

The trade of the Marshall Islands consists in the exportation of kopra, and the importation of dress stuffs, provisions, manufactured iron goods, wood for building purposes, and money. It is entirely carried on by a number of German, English, and American firms, whose representatives on the islands at present number sixty-four.

Regular postal communication has not as yet been established with the Marshall Islands, but mails are carried by the ships belonging to the various companies interested in the kopra trade. Business is transacted almost entirely by means of cash payments, the chiefs having quite a passion for money, of which they are said to possess considerable hoards. The current coin is the Chilean dollar, but English gold is occasionally used, the sovereign being worth five dollars.¹ — *Deutsche Kolonialzeitung*, Heft 23, 1886.

¹ For further information regarding the Marshall Islands, see *Die Marschallinseln in Nord- und Völker-Kunde, Handel und Mission; mit einem Anhang: Die Gilbertinseln*. By Karl Hagei: published by George Lingke, Leipzig.

Kilauea Volcano, in Hawaii.—The crater of this volcano lies in the south-west of a vast depression—which is roughly triangular in shape, with sides measuring about 3350 feet—and is a pit 12,000 (*sic*) feet long, 3000 feet wide, and 384 feet deep (greatest depth 570 feet). Above this crater, which bears the name of Halema'uma'u, and about 600 feet below the highest part of the western rim of the entire depression, occurs the "black ledge," a shelf of desiccated lava from 600 to 2000 feet wide. To the east of Halema'uma'u lie the smaller temporary craters, Little Beggar and New Lake, which together constitute a sort of shelf or terrace adjoining the main depression, and embrace an area 1700 feet in length by from 250 to 650 feet in width; its average depth is 165 feet. The floor of the depression in the neighbourhood of these lakes is 160 feet higher than at its northern end. Since 1887, the principal crater and New Lake had been pouring out discharges of lava over the floor of the depression, till by March 6, 1884, it had accumulated to the height of 3719 feet above the sea-level. On the night between March 6th and March 7th, this mass of lava—a column of molten rock 570 feet thick—disappeared through a subterranean channel. This was attended by a series of forty-three earthquake shocks, lasting through the night. Besides the pit thus formed by the disappearance of the lava, several large cracks were produced outside the principal depression itself. On June 4th (down to which day darkness and quietness reigned over the scene), a huge chasm, 40 feet across, was observed on the east side of the above-mentioned pit, having walls which descended at an angle of eighty to eighty-five degrees to a lake of fire and liquid lava beneath. Twenty-one days later, two larger vents, divided by a very narrow ridge, were formed at the level of the deepest part of the pit, being 700 feet long by 400 wide. It seems probable that the mass of lava which disappeared must have been received into some subterranean cavity, since it is not known to have been discharged anywhere on the surface, nor has any oceanic disturbance taken place within reasonable distance of the island. The lava has begun to return again, having, by October, built up a cone from the bottom of the pit 700 to 800 feet high. Previous discharges of accumulated lava took place in 1789, 1823, and 1840. In 1823, the lava rose to an altitude of 3177 feet above sea-level, and in 1840 to 3170 feet.—C. H. Hitchcock, in *Science*, February 25, 1887.

MISCELLANEOUS.

Mr. H. M. Stanley telegraphed his arrival at the Congo on the 18th March.

A line of steamships to run regularly, in connection with the Canadian Pacific Railway, between **British Columbia and the Australian Colonies**, is promised for the coming summer.

Lieutenant Wester, late Commandant at Stanley Falls, is about to undertake, for the Swedish Government, an exploring expedition to the region east of the Cameroons, towards the sources of the northern affluents of the Congo.

L'Afrique, March 1887, gives a map, reproduced from the *Kolonial Zeitung*, to illustrate the treaty of November 1, 1886, defining the spheres of interest of Germany, England, and the Sultan of Zanzibar respectively, in East Africa.

Dr. Holub.—The German and Austrian Consulates at the Cape have received telegrams confirming the information which has already reached this country of the attack on Dr. Holub's expedition, between the Zambesi and Lake Bangweolo. Dr. Holub was not himself with the expedition at the time, but a European, Oswald Toldner, was murdered, and his valuable collections were lost. News from Shoshong announces the arrival of Dr. Holub, in a deplorable condition, at that place. According to the latest (23d February) information, Dr. Holub

arrived on 22d February, in company with his wife, at Bamangwato, where he received assistance from the firm of Poppe and Co. in Cape Town.

Another attempt to reach the **North Pole** single-handed is being made by a Canadian. According to the *Scotsman's* Ottawa correspondent—"Mr. Alexander Macarthur, a former *employé* of the Hudson Bay Company, started on his northward trip from Winnipeg on the 20th March, with only one companion. Sleighing is to be used until Norway House is reached and dog-trains thence, proceeding due north to Fort Churchill. From that point he will make divergence to Chesterfield Inlet to see the New Bedford whaler wintering there, from which he hopes to gain some useful information, and by which vessel, on its return, he will forward the only communication to the world he leaves behind, until his return, as, once past that inlet, the dreary Polar wilderness has to be entered. By the middle of May, Mr. Macarthur expects to reach Boothia Felix, whence he will push forward through Somerset and Devon Land, keeping west of the Greely route, and in an entirely unexplored country. Hitherto exploring parties have attempted to reach the Pole by passing from Baffin's Bay through a succession of straits to Lincoln Sea. Here the ice was found so uneven by the Greely party that dog-trains could not pass over it. The roughness of that ice the present explorer attributes to icebergs coming down from the Pole piling up, on striking the shore. West of it there is an open sea, which permits the bergs to drift away southwards, and there he expects to find comparatively smooth ice, over which he hopes to reach the Pole with comparative ease. He is well supplied with instruments and with trinkets for Eskimo trading, and he takes provisions for two months, after which the two explorers will have to depend on their rifles for food. He expects to be absent three years."

NEW BOOKS.

The Statesman's Year Book: Statistical and Historical Annual of the States of the Civilised World, for the year 1887. Edited by J. SCOTT KELTIE, Librarian to the Royal Geographical Society. Twenty-fourth annual publication. Revised after official returns. London: Macmillan and Co.

Time and States change, and the *Statesman's Year-Book* changes with them, chiefly in the way of growth. It is evident enough, from a glance over this twenty-fourth volume of the series, that there has been considerable sacrifice and self-denial exercised for the purpose of bringing it within the compass of a thousand pages, at which figure, by general consent, a book of the kind becomes recognised as overgrown and over bulky. A large amount of valuable new matter has been added, partly the product of the development of civilisation and statistics, and partly the result of further research by the editor, with the object of making the Annual as complete and useful as possible. But, on the other hand, there has been retrenchment to the extent of some score of pages or more; and the period when the volume will reach the bourne of a thousand pages has been postponed to the year after the Jubilee. Of the additions made, the most important, especially from a geographical point of view, is the extra space of fifteen pages devoted to the smaller British Colonies, which have not a special place reserved for them apart from the mother country. The new statistical and general information, with regard to these colonies, appears to have been assiduously collected from the official returns, and brought carefully down to date; and it is in all respects an excellent and valuable feature of the work.

Notices of the land-tenure system of British India and a new section of agricultural statistics have this year been included ; the province of Upper Burma has also its place under the Indian heading ; and the progress and importance of Corea is recognised by separating it from the Chinese Empire. Effect has been given to the latest developments of French and German colonial enterprise under the proper headings ; and, among a host of other things, notice is taken of recent political changes in the East of Europe, the additions made to continental armies and navies, and the latest phases of Egyptian finance and Australian federation. Mr. Scott Keltie is to be complimented upon a work which so adequately maintains the high reputation gained by previous volumes.

L'Expansion Coloniale de la France : Étude Économique, Politique et Géographique sur les Établissements Français d'Outre-Mer. Par J.-L. de LANESSAN, Député de la Seine. Avec 19 Cartes hors Texte. Paris : Félix Alcan, 1886. Price, 12 francs. Pp. xxiii. and 1016.

The efforts of the French nation to establish themselves in countries beyond seas seem to have been dogged by a perverse and spiteful fate. They have taken possession of many fair stretches of fertile territory, have made beginnings of colonisation there, and erected what they hoped would prove to be the cradles of affiliated or subject empires. But just as they were, metaphorically, closing their hand upon their prize, an enviable destiny has snatched it from between their fingers. Of the vast territories once subject to the sway of France in North America and India, and other parts of the world, at the end of the eighteenth century, there remains in her possession to-day only a few small islands and detached districts, such as Réunion, Pondicherry, French Guyana, Guadeloupe, and Martinique. Of her existing dependencies beyond the frontiers of the mother country, nearly all the rest have been acquired since 1814-1815, and several of them, such as Madagascar, a large part of Senegambia, a large part of the possessions between the Congo and the Gaboon on the West Coast of Africa, Tunis, Annam, and Tonquin, have been brought under French dominion since 1880. The French dependencies in Hindustan have long been in English hands ; so, too, have the colony of Quebec and that of Acadia, whilst the extensive territories once included under the designation of Louisiana were sold by Napoleon the First to the United States more than eighty years ago.

Although, at the present moment, France possesses vast expanses of territory beyond seas—possessions which, in point of area and population, make a formidable show on paper—it cannot be said that she has any true colonies—that is, countries settled and permanently cultivated by Frenchmen. Even the oldest colonies—Réunion, Martinique, Guadeloupe, and French Guyana—are not, strictly speaking, colonies, such as are New Zealand, Australia, Canada. The people who own them, and cultivate in them the various products they respectively yield, are *métis* or people of mixed blood, the offspring of French and coloured parents. Nor do any of the newly-acquired dependencies of the Republic seem to hold out reasonable hopes that they can be converted into French colonies, analogous to those of England mentioned above. For, in the first place, they are situated for the most part within the tropics ; this is true, as a glance at the map will show, of Madagascar, the Congo and Gaboon territories, Senegambia, Cambodia, Cochin China, Annam, and Tonquin. On this account they do not offer very strong inducements to the right class of colonist to emigrate thither with a view to making a permanent settlement. Algeria and New Caledonia are the only dependencies whose climate seems to be at all adapted to Europeans, and in these countries, for various reasons, colonisation by French-

men is not the success it might be. In the next place, the French Government seems to be actuated by other considerations than those of creating a "France beyond seas." Apparently their aims are military; at any rate their policy is only explicable on the assumption that they are mainly concerned to extend the sway of the Republic over as many of what may be designated constituent elements of a great French empire as possible. Many of her newly-acquired dependencies can as yet, it is pretty evident, serve no other purpose save that of flattering the national pride; on the contrary, they must be a direct burthen upon the national exchequer, since the expenditure necessarily entailed in establishing and maintaining French influence, in nearly all those cases, by dint of military power, must be very considerable. Moreover, it must be added that those islands which are well-settled and have long been subject to cultivation at the hands of populations who have been acquainted, to some extent at least, with European methods of agriculture, are at the present moment in anything but a flourishing condition. The prosperity of Réunion, Guadaloupe, and Martinique, together with French Guyana (in part), was destroyed by the emancipation of slaves.

The present bulky work by *M. de Lanessan* contains a mass of most valuable information on nearly all subjects connected with these vast and widely-scattered dependencies of the French Republic. With respect to nearly all the points upon which a reader would consult such a book, the author has something to say. He has given the widest interpretation to his task, and embraced within its scope nearly every branch of geographical science—physical, commercial, historical, sociological. And although he deals with such a formidable mass of materials as is implied in a volume of over a thousand pages, yet he does not lose control of his subject—neither forgetting the broad lines of general treatment in the multiplicity of details, nor, amid the complexities and intricacies of innumerable particular facts and figures, losing sight of the requirements of logical order and natural arrangement. Indeed, if a teacher of geography were in search of a work whereby to illustrate the advantages that can accrue from a study of geography—how it requires accuracy, precision, grasp of detail, power to combine many particular facts under leading ideas, logical and orderly arrangement, scientific conceptions of the leading principles of geographical procedure, to say nothing of the demands it makes upon a wide acquaintance with various branches of natural science, and with history, ethnology, commerce, etc.—the geographical teacher would, we repeat, find this book very useful as an illustration. *M. de Lanessan* has brought his statistical information down to quite recent years—as recent as we might expect, when we consider the almost gigantic labour he must have gone through in the preparation of his work. Nevertheless, had he taken a little further trouble, and, instead of quoting at such length from official documents (decrees, acts, reports), geographical works, the writings of travellers and others, he might, with advantage, by condensation and abstracting, have reduced the bulk of his volume to an appreciable extent. This remark is not, of course, intended to apply to the reprint of such documents as the text of the treaty between France and Madagascar of December 17, 1885. For such an important work the maps are disappointing, being neither full enough nor artistic in appearance. In this, as in most French and German scientific books, we feel painfully the want of an index.

To give a rough indication of the author's treatment, we append an abstract of his sectional headings on Algeria and Tunis, which he treats together:—*I. Physical Geography of Algeria and Tunis*: (a) the mountains; (β) the Tell; (γ) the high plateaus; (δ) the Sahara chain; (ε) the desert; (ζ) hydrography; (η)

the shotts—the interior sea ; (θ) wells ; (ι) coasts and ports ; (κ) principal centres of trade and population ; (λ) means of communication—railways—roads ; (μ) population. II. Conquest and colonisation ; (α) the military *régime* ; (β) system of land tenure in Algeria ; (γ) sales and concessions of land ; (δ) system of *cantonnement* ; (ϵ) the decree of the Senate of 1863 ; (ζ) official and free colonisation ; (η) the Torrens Act ; (θ) landed property in Tunis ; (ι) European population ; (κ) climate ; (λ) objects of cultivation in Algeria ; (μ) forests ; (ν) cattle-rearing ; ($\omicron$) commerce. III. Administration : (α) in Tunis ; (β) capitulations ; (γ) international financial committee ; (δ) Tunisian schools ; (ϵ) in Algeria ; (ζ) departmental and communal administration ; (η) budget of Algeria ; (θ) customs' dues. V. General conclusions : (α) abolition of free concessions ; (β) offices for information about emigration ; (γ) roads and means of communication ; (δ) individual property ; (ϵ) schools ; (ζ) administration in Algeria ; (ι) abolition of government by decrees ; (κ) Tunis. All this embraces 112 pages.

The longest chapter, more than 200 pages, is entitled "France in Indo-China," i.e. Cambodia, Annam, Cochin China, and Tonquin. The remaining chapters are on France in West Africa ; in East Africa ; in India ; in Oceania ; in the New World ; on European, Indian, African, Chinese, etc., immigration into these French colonies ; on penal colonisation ; on the organisation, administrative, financial, military, judicial, economic, etc., of the French colonies. The chapters on penal colonisation and immigration are especially interesting and instructive ; and we regret that our space will not allow us to discuss some of the more important problems of which they treat.

The accompanying table gives *M. Lanessan's* list of the French possessions in different parts of the world :—

CONTINENT.	FRENCH POSSESSIONS.
AFRICA, . . .	Algeria ; Tunis ; Senegal ; Rivers of the South (between rivers Casamance and Scarcies) ; Assinia and Great Bassam (on Gold Coast) ; Porto Novo, Great Popo, and Agué (on Slave Coast) ; Gaboon and Congo districts (stretching from River Campo to Point Chamba at the junction of the Loema and Lubinda, except Elobey and Corisco Islands in Corisco Bay) ; Obock (south of Red Sea) ; Nossi-Bé, Mayotte, Sainte Marie (islands off coasts of Madagascar) ; Madagascar ; Réunion.
ASIA, . . .	Annam ; Cochin China ; Cambodia ; Tonquin ; Carical, Pondichery, Yanaon, Chandernagore, and Mahé (in Hindustan).
OCEANIA, . . .	Society Islands ; Archipelago of Tuā-Motu ; Gambier Archipelago ; Marquesas Islands ; Archipelago of the Tubuai, with Rapa ; Clipperton ; Archipelago of New Caledonia ; Loyalty Islands ; New Hebrides.
SOUTH AMERICA,	French Guyana.
NORTH AMERICA,	Martinique ; Guadeloupe ; St. Pierre and Miquelon (off Newfoundland).

The Balkan Peninsula. By ÉMILE DE LAVELEYE. London : T. Fisher Unwin. 1887. 1 vol., pp. 372 ; Index. Price 16s.

The original French edition of this work has already been reviewed in the pages of our Magazine (*La Péninsule des Balkans*), vol. ii. page 699. The present volume is a translation by Mrs. Thorpe. In several ways the English edition is to be preferred : some judicious excisions have been made in order to

reduce the two volumes of the French edition into a single volume; an introductory chapter by *M. de Laveleye* narrates very clearly the present position of Bulgarian affairs; and a Political Map has been added. The present work well deserves its translation into English, and will probably have a larger circulation in this country than in France.

Mr. T. Fisher Unwin, the publisher, has produced a very attractive volume. If another edition is called for, we would recommend the substitution of a more scientific map in place of the existing one: it would materially assist the reader in unravelling the intricate political and ethnical problems of the Balkan States if the physical features of the Peninsula were more clearly indicated.

Geological and Natural History Survey of Canada. Annual Report (New Series), Vol. 1., 1885. Montreal: Dawson Brothers. 1886.

This volume is published by the authority of the Canadian Government, and reflects much credit on the Survey, of which Dr. Alfred R. C. Selwyn is Director. It is accompanied by a portfolio containing well-executed maps of (1) a portion of the Rocky Mountains (Bow to Livingstone Ranges, etc.); (2) the Cypress Hills, Wood Mountain, and adjacent country (geological and topographical); (3) the same (wooded tracts, and character of surface); (4) Lake Mistassini; (5) Nova Scotia and New Brunswick; and (6) the province of New Brunswick. The second and third maps will be of great use to settlers. They embrace a vast district, from Mortlake to Medicine Hat on the Canadian Pacific Railway, and point out good and bad land. As in the United States, topographical, geological, and agricultural surveys go hand-in-hand in Canada, as otherwise the immense territory to be surveyed would not be undertaken in time to satisfy the Government or the settler.

The volume before us opens with a summary report by Dr. Selwyn of the operations of the Geological and Natural History Survey of Canada for the years 1884 and 1885. Eighteen separate geological explorations were carried out during the summer of 1884. During 1885, the Survey officials were also actively engaged, botanical work being as usual energetically undertaken, so that during the year, 2957 species, labelled and named, were distributed among various colleges in Canada, or sent to individuals in exchange for other plants.

The next report is a preliminary one by Dr. George W. Dawson on the physical and geological features of that portion of the Rocky Mountains between latitudes 49° and 51° 30'. Dr. Dawson treats fully of the Cascade coal-basin in the valley of the Bow River, remarking—"The most interesting and important circumstance connected with this part of the Bow Valley is the fact that it is underlaid throughout its length by cretaceous coal-bearing rocks of the Kootanic series. The coal, which is an anthracite, was first discovered, I believe, in 1883. It is now being opened up, and promises to be of considerable importance on account of its position on the Canadian Pacific Railway line, and its excellent quality. Gold has also been discovered at Wild Horse Creek, which has proved richly auriferous; whilst copper and lead ores occur in this portion of the Rocky Mountains in considerable abundance."

Mr. R. G. Mc'Connell next furnishes a report on the Cypress Hills, Wood Mountain, and adjacent country, embracing part of the district of Assiniboia, and treating of the country lying immediately east of the Bow and Belby rivers' district previously reported on by Dr. Dawson. Several excellent phototype illustrations accompany this report, which is followed by one on the Geology of the Lake of the Woods region, by Mr. Andrew C. Lawson. This region is extensively glaciated. "Everywhere," says Mr. Lawson, "the rocks display unmistakable

evidence of the polishing and grooving effects of the passage of detritus laden ice over the surface of the country." Then follow several pages containing a record of the directions of the glacial groovings and striæ, showing the extremely careful and painstaking manner in which the Canadian Geological Survey is conducted.

The next report is one by Mr. A. P. Low, of the expedition in 1884-5 to Lake Mistassini, and adjoining country in Hudson's Bay Territory, with a list of birds and plants collected by Mr. James M. Macoun. Following this, Dr. Robert Bell contributes observations on the Geology, Zoology, and Botany of Hudson's Strait and Bay, made in 1885, illustrated with a beautiful engraving of the Labrador coast, and another of Prince of Wales Sound. Mr. R. W. Ells and Dr. Bailey follow with reports on the Geological Formations of parts of New Brunswick and Nova Scotia, whilst Mr. R. Chalmers furnishes a preliminary report on the Surface Geology of New Brunswick, treating exhaustively the subjects of glaciation and "kames." The conclusions at which Mr. Chalmers arrives regarding the glacial epoch in New Brunswick are briefly as follows:—"(1) A mass of ice accumulated on the surface of the country, and moved from the higher interior region towards the Bay of Fundy on the one hand, and the St. Lawrence on the other; (2) this movement was accompanied by a great transportation of drift or decayed rock-material, which had been formed on the surface previous to the Ice Age; (3) river valleys were partly filled, and the rivers themselves dammed up by this drift; while lake-basins were formed, not, as far as the evidence goes, from erosion of the rocks by the grinding power of the ice, but by (a) the scooping out of loose materials from hollows in rock, thus forming rock-basins, and (b) by leaving depressions in the drift occupying pre-existing valleys, which afterwards caught the drainage of the areas surrounding them; (4) on the melting and breaking-up of the ice-covering, either smaller ice masses have slid down the slopes more directly towards the low marginal areas, or into the adjoining seas; or, as the land sank, icebergs may have grated the slopes, especially of the northern and eastern coast areas of New Brunswick. With regard to the *thickness* of the ice, even when the glacial period had attained the maximum degree of cold, Mr. Chalmers considers that it cannot have been very great. Striæ were found at one place 600 feet above the sea-level, and here the ice may have been 900 to 1000 feet thick—a less thickness would not explain the facts—and it probably did not much exceed this in any part of New Brunswick. The fact of its having enveloped mountains 2000 feet high in the interior does not require that it should be much thicker, because it would necessarily have a slope on the surface corresponding with the slope of the country from there down to the marginal area.

The volume under notice closes with observations on mining laws and mining in Canada, by Mr. Eugène Coste, and chemical contributions to the geology of Canada by Mr. G. Christian Hoffmann. From first to last this volume is creditable to Canada; and, from the amount of precise and reliable information which it contains, it should be of the greatest service to the settler, the traveller, and the man of science, besides advancing the general knowledge of the public, and promoting the development of the mineral and agricultural resources of the Dominion.

Surinam: Sein Land, seine Natur, Bevölkerung und seine Kultur-Verhältnisse, mit Bezug auf Kolonisation. Von AUGUST KAPPLER, früherem holländischem Kolonialbeamten. Mit Holzschnitten und einer Karte. J. G. Cotta, Stuttgart, 1887. Pp. 383.

The writer of this book, the main portion of which has been appearing in serial form in *Globus*, has lived forty-three years in the country about which he

writes. He went out to Surinam as a soldier in the Dutch colonial army, and enjoyed excellent opportunities for becoming thoroughly acquainted with his adopted home. He writes like a practical man, and writes mainly for practical people. His book, which he intends to be a contribution to the Colonial question deals especially with the problem of the colonisation of tropical lands by Europeans. And what he says upon this important topic should be of noticeable value, since he bases his statements upon his own experience, which, considering the long time he spent in the colony, ought not to be disparaged. Herr Kappler advocates the feasibility of colonies of Europeans being successful in tropical regions; but, in order to secure this success, various precautions and measures must be adopted, which the ordinary colonist from the civilised countries of Europe finds it irksome to practise, and frequently so much so that he pays the penalty of disregarding them by the loss of his property, his health, his life. Those who seriously contemplate settling in a tropical climate—which at all resembles that of Surinam, a country stretching from 2° to 6° north of the equator—should read the minute prescriptions and the wholesome advice recorded for their benefit in the book before us,—and all the more that it is advice tendered in a wise, candid, and temperate spirit, and enforced by much sound common-sense. The author is principally concerned to state the details of agricultural work as pursued in a country like Surinam, whose chief products are sugar, coffee, cocoa, cotton, cassava, arrowroot, bananas, and other tropical fruits.

The Colonial question is treated of in the latter part of the book. The earlier parts, after a short introductory chapter giving a general description of the country and its leading physical features, describe its flora and its fauna, its climate and its inhabitants; and one chapter is devoted to an account of Paramaribo, the capital, and of the government of the colony. In discussing the flora and fauna, Herr Kappler's treatment is not so much that of a man of science as that of a practical but careful observer, whose interest in what he describes was mainly determined by considerations of utility. In other words, his account of the trees and plants, of the animals, insects, birds, and fishes of Surinam, is such as we should expect from a thoughtful dweller in the midst of the many useful and beautiful things and beings by which during so many years he was constantly surrounded. It need hardly be added that this part of his book contains several relations which have all the charm of the personal, nor that the book as a whole possesses many interesting features, not only for the prospective colonist, and not only for the ordinary reader, but also for the scientific student of botany and zoology.

The map which accompanies the volume has a very bare appearance, little being indicated beyond the course of the main river, the Maroni, and the riverine tracts adjoining the coast-streams of the north. In fact, little more than this seems to be known of the country, which is not in a flourishing condition.

NEW MAPS.

(*Edited by Professor James Geikie, LL.D., F.R.S.*)

AFRICA.

BLANTYRE to ANGONI-LAND—Sketch-map, illustrating the Journey of Mr. J. T. Last. Scale, 1 : 1,108,800.

Proceedings of the Royal Geographical Society, March 1887.

CORISCO BAY. Exploraciones de los Sres. Iradier, Montes de Oca y Ossorio en los territorios españoles del Golfo de Guinea. 1884-1886. Plano general arreglado por D. Francisco Coello. Escala de 1 : 1,000,000.

Madrid : Revista de Geografía Comercial, Julio-Setiembre de 1886.

MOCAMBIQUE, Provincia de—, Carta provisoria da Viagem de exploração de Serpa Pinto e Augusto Cardozo, 1884-86. Co-ordenada por A. A. d'Oliveira. Escala, 1 : 2,000,000.

Boletim da Sociedade de Geographia de Lisboa, 6ª Serie, No. 8.

This provisional sketch-map shows the extent and general results of Serpa Pinto's explorations in the country lying to the east and south-east of Lake Nyassa. There can be no doubt that this valuable work by the Portuguese will go far to establish their disputed claim to that territory.

MOCAMBIQUE, Provincia de—, Itinerario da Viagem entre Inhambane e Lourenço Marques, feita em 19 de Outubro a 16 de Novembro de 1885 pelo conductor de 2ª Classe I. Armando Longle do quadro das Obras Publicas de Moçambique.

Boletim da Sociedade de Geographia de Lisboa, 6ª Serie, No. 7.

OGOOUE, FLEUVE, entre la Riv. Lolo et la Riv. Passa, avec partie des Rivières Passa et Liboumbi, relevés par L. Mizon, Lieut. de Vaisseau, 1881-1883. Echelle, 1 : 100,000. Pl. 1, et 2.

Paris : Bulletin de la Société de Géographie, 4ª Trimestre, 1886.

These beautiful and elaborate maps of the upper course of the Ogowe River form a very substantial contribution to the mapping of the French Congo Territory.

GENERAL.

BERGHAUS' PHYSIKALISCHER ATLAS. Achte Lieferung. Inhalt : Nr. 30, Isothermen von Europa (Dr. J. HANN) ; Nr. 49, Florenkarte von Afrika und Australien (Dr. O. DRUDE) ; Nr. 57, Amphibien und Fische (Dr. W. MARSHALL).

Gotha : Justus Perthes, 1887. Price M. 3.

The maps in this part, like all those already issued in this atlas, bear every evidence of the most minute and thorough research, combined with great beauty of cartographical execution.

BRITISH EMPIRE ATLAS, John Heywood's—, showing the Dependencies and Colonies of Great Britain, etc. *Manchester : John Heywood. Price 1s.*

For blunders, inconsistencies, and general inaccuracy, it would be difficult to find another atlas to rival this production of Mr. Heywood's. Briefly, it may be described as merely so much paper and print in a neat cover ; there is no evidence of either system or geographical knowledge having been brought to bear on its preparation.

COLONIAL AND INDIAN ATLAS of the British Empire. Twenty-nine plates, and descriptive letterpress. 1887. *Edinburgh : W. & A. K. Johnston. Price 5s.*

This atlas gives a fairly complete and minute representation of the various countries composing the British Empire at the present day. There are, however, one or two noticeable errors, such as the omission of Sokotra in the map of the British Empire, and the delimitation of the provinces of Ontario and Manitoba with their old boundaries. The addition of an index and a table of the British Colonies and Possessions would have increased its usefulness.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ON THE LAND SLOPES SEPARATING CONTINENTS AND OCEAN BASINS, ESPECIALLY THOSE ON THE WEST COAST OF AFRICA. OBSERVED AND SURVEYED IN THE S.S. "BUCCANEER," BELONGING TO THE INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPH WORKS COMPANY (LIMITED) OF SILVERTOWN.

(With Diagrams.)

By J. Y. BUCHANAN.

IN the year 1883, owing to the kindness of the Silvertown Company, I had the advantage of accompanying the ships surveying the route of the cable connecting Spain with the Canary Islands. In the course of this survey several unsuspected shoals rising abruptly out of deep water were discovered and carefully investigated. Numerous and very close soundings made round the edges of these shoals showed that they were in all cases very steep, and in one or two instances direct evidence was obtained that they were precipitous.

The seaward slopes of the volcanic islands forming the Canary group were also carefully sounded, and they were found almost always to be very steep. They differed, however, in character from the slopes of the banks. These consist always of shell or coral—indeed, good evidence was obtained to show that they have in most cases been built up from great depths by deep-sea corals, and their sides are steep all round, but not much indented. In the case of volcanic islands, on the other hand, the lava streams or flows which form the substance of the visible island, and give it its rugged character, are continued with much the same features below the surface of the ocean, from the bottom of which they have been raised or built up by the solidification of successive overflows of melted lava. Both above and below water, these flows, when solidified,

form radiating ridges, separated by deep and rugged ravines which can usually be traced to a depth of 800 or 1000 fathoms.

In the beginning of the year 1886, I accompanied the expedition sent to survey the route for the continuation of the cable down the coast of Africa, from the French settlement Conakry, about 70 miles north of Sierra Leone, as far as St. Paul de Loanda, in lat. 9° S.

The s.s. *Buccaneer*, which was selected for this service, left Conakry on 31st December 1885, and began work immediately, sounding round the coast of the Gulf of Guinea. This gulf is the receptacle into which the great easterly counter-equatorial current of the Atlantic, often called the Guinea Current, empties itself, and the source from which proceeds the great equatorial current which runs in a westerly direction all the way across the Atlantic, and is probably the most powerful proximate factor in the production of the Gulf Stream. Hitherto these waters had been entirely unexplored, and even hurried investigations could not fail to give interesting results.

The chief object of the expedition was to delineate the seaward continental slopes, with the view of discovering a suitable bed for the cable about to be laid. This was done by carrying a continuous line of soundings parallel to the coast, in depths of about 1000 fathoms, and interrupting it at more or less regular intervals by short lines of soundings at right angles to the coast. The soundings on these lines were usually taken very close together, and they give a very accurate profile of the side of the ocean basin at the particular locality. Extended series of observations of the temperature and the density of the water at different depths were made. The tow-net was used constantly for making collections at different depths, and the mud was sampled with the sounding tube and the dredge; but the results of the soundings themselves are perhaps the most interesting of all.

In carrying out work of this kind, it is not uncommon in surveying practice to make soundings every 10 miles or every 5 miles, or at less intervals; in the *Buccaneer* it was endeavoured to place the soundings on the lines of profile, at such distances apart that no two consecutive ones should differ by more than 200 fathoms. On certain parts of the coast this necessitated taking soundings half a mile apart at the steepest part of the slope, and it was usual to take them at distances not more than 2 miles apart as long as the depth ranged between 100 and 1000 fathoms. Profiles based on soundings of this degree of closeness give a fairly accurate representation of the continental slope of the bottom of the ocean. Indeed, even in running lines of soundings across the middle of the ocean, it is better, and gives much more useful information, to place the soundings at alternate long and short distances apart. Thus it is better to take soundings along such a line at alternate intervals of 9 miles and 1 mile than at regular intervals of 5 miles. In most cases the 9-mile soundings will give as much information as the 5-mile ones, but the 1-mile soundings at an average distance of 10 miles apart give definite and precise

information about the actual nature of the bottom, and not merely its average character, which is all that can be learned from widely spaced soundings.

Between Sierra Leone and Porto Novo, a French settlement about 50 miles west of Lagos, fourteen profiles were sounded. In Fig. 4 some of the more characteristic ones are represented graphically. Most of them were off prominent points on the coast, or points of proposed landing for the cable. They showed that the bottom of the ocean at the edge of the continent has a roughly-terraced shape. First, we have the coast flat, running from the shore out to 100 fathoms; this along the Guinea Coast is generally about 12 or 15 miles broad, and is very flat until a depth of 30 fathoms is reached, when the depth rapidly increases to 100 fathoms. The slope gets rapidly steeper, attaining a maximum generally between 200 and 400 fathoms. Between 500 and 1000 fathoms it becomes less steep, and indeed along a considerable part of this coast there is a very well marked terrace at about 700 fathoms. Between 1000 and 1200 fathoms a further steepening occurs, after which the slope gradually flattens out towards the deep water, though a slight steepening is frequently noticed at about 1800 fathoms. The soundings along this coast revealed a rather remarkable law—namely, that the slope on the east side of the principal points or headlands is always much steeper than that on its west side. This is well shown at Cape Palmas, Cape Three Points, and Cape St. Paul. On the Krou coast, west of Cape Palmas, the 100-fathom line projects out in a tongue, and the slope down to 600 fathoms is gentle—not more than 70 fathoms per mile; and there is reason to conclude from the temperatures of the bottom water at great depths, observed east and west of this point, that a line could be traced from it to Ascension Island, with a depth nowhere exceeding 1800 fathoms. The distance of the 500-fathom line from the 100-fathom line is 11 miles off the Krou coast, and approaches within 25 miles of it, off and slightly to the eastward of Cape Palmas. The distance from the 100-fathom to the 1000-fathom line is 22 miles off the Krou coast, and 11 miles off Cape Palmas. The profile off Cape Palmas is remarkable, giving a very high average slope down to very deep water. From 100 to 1500 fathoms there is an average increase of depth at the rate of 150 fathoms per nautical mile. Judging from analogy, there can be no doubt that part of the slope must be very much steeper. After rounding Cape Palmas, and on entering the large bight to the eastward of it, the steepness of the continental escarpment seems to increase. In longitude 7° W. a depth of 1054 fathoms was found at a distance of 11 miles from the coast, and only 3 miles from the 100-fathom line, as indicated on the Admiralty chart. This steepness of escarpment at depths between 100 and 1000 fathoms is found to continue all round the bight which stretches from Cape Palmas to Cape Three Points. The ground flattens much at depths over 1000 fathoms, and the result of the soundings was to show that, while the contour lines of 500 and of 1000 fathoms follow closely the

direction of the coast-line, the 1500-fathom line keeps an east and west direction across the bight. Off Cape Three Points the 100-fathom line runs out to a distance of 40 miles from the coast. On the west side of this point the slope was found comparatively gentle—the contour lines of 100 and of 500 fathoms being about nine miles apart. A remarkable profile was obtained on the eastward slope of Cape Three Points. The position of the ship having been carefully verified by the land, a sounding was taken in 30 fathoms, which agreed well with those found on the chart. The next sounding gave a depth of 434 fathoms, and then three soundings, at distances little over two miles apart, gave depths of 1083, 1727, and 1973 fathoms, giving evidence of declivities of altogether exceptional steepness. Between 434 fathoms and 1083 fathoms the depth increases at the rate of 232 fathoms per mile, and between 1083 fathoms and 1727 fathoms it increases at the enormous average rate of 322 fathoms per mile. Between 1727 and 1973 fathoms it falls off to the still considerable rate of 91 fathoms per mile. On this, the steepest slope observed, the distance from the 100-fathom line to the contour line of 500 fathoms is 1·8 mile; to that of 1000 fathoms, 3·8 miles; to that of 1500 fathoms, 5·3 miles; and to that of 2000 fathoms only 8·9 miles.

A comparison may be made between the slopes indicated by these soundings and those of well-known mountainous countries. The highest and the best known mountain in the British Islands is Ben Nevis. It is 4406 feet above the sea-level, and the horizontal distance between its summit and Fort-William at its base is about 4 nautical miles. The average slope between these points is 1100 feet per mile, and it is along this line that the path for the ascent is carried, and it is good mountain walking. The shortest horizontal distance between the summit and the valley of Glen Nevis is 2 miles, and the descent over 4000 feet, giving an average slope of 2000 feet per mile; and no one would describe the country lying on the line connecting these two points otherwise than as a succession of precipices. The average slope between our soundings of 434 and of 1083 fathoms is 232 fathoms, or, in round numbers, 1400 feet per mile, and between those of 1083 fathoms and 1727 fathoms it is 2000 feet per mile. Moreover, both at 434 and at 1083 fathoms the bottom was hard rock. There seems, therefore, no reason to suppose that the continental slopes forming the sides of the ocean basins do not rival in steepness and in ruggedness those of the most mountainous regions of the land surface. Fig. 5 represents a comparison between the slopes observed on the deep profile at Cape Three Points (No. 1), and two profiles of Ben Nevis (Nos. 2 and 3), as taken from the Ordnance map. No. 2 represents the profile on a northerly line from the top to the sea at Banavie, and No. 3 represents the profile in a westerly direction from the top to the bed of the river Nevis. It will be seen that the average slope between the soundings at 1083 fathoms and 1727 fathoms on line No. 1 is very little less than that of the line (No. 3) from the top of Ben Nevis to the bed of the river, and this is nothing but a series of precipices.

At Cape St. Paul the same law was found to hold — namely, that its eastward slope is steeper than its westward one; but the slopes generally become gentler on entering the Bight of Benin. From Porto Novo, in long. $2^{\circ} 30' E.$, a line of soundings was carried across the Bights of Benin and Biafra to the island of St. Thomas. The continental slope of Porto Novo was found to be much gentler than in previous profiles, and this was to be expected on approaching the head of the bay into which the Niger and other great rivers pour their waters and the abundant land *débris* brought down by them. Between the coast and the island of St. Thomas the soundings were carried in a direct line $S. 34^{\circ} W.$, with occasional soundings to the right and left of the line in order to show the slope of the bottom. For nearly one half of the way the line runs parallel to the coast, forming the western margin of the delta of the Niger, and at a distance of about 100 miles from it. For the remainder of the route it crosses the mouth of the Bight of Biafra. The bottom is very uniform, both as regards elevation and nature. Although there seem to be no steep ridges or valleys, there are some well-marked depressions and elevations which deserve to be noticed. A first maximum depth of 1783 fathoms was met with in lat. $5^{\circ} 15' N.$ and long. $3^{\circ} 10' E.$, which no doubt indicates the line of the deepest water of the Bight of Benin, terminating in the remarkable gully called Avon's Deep, a little to the eastward of Lagos. Proceeding southwards, the water shoals gradually to a minimum observed of 1391 fathoms, in lat. $3^{\circ} 55' N.$, long. $4^{\circ} 7' E.$ It then deepens rather rapidly in the next 25 miles to 1916 fathoms, and the bottom remains very level until it begins to rise rapidly towards the volcanic island of St. Thomas, where the slopes had precisely the same character as those observed in the Canary Islands. Prince's Island, to the north-east of St. Thomas, has also the steep and irregular escarpments of volcanic islands, and between the two islands the water attains a depth of 1600 fathoms.

After leaving Porto Novo, and all the way as far south as St. Paul de Loanda, the soundings showed an altogether different character of water and bottom from that observed westward of Cape St. Paul. There the gradients were steep, here they are gentle; there the bottom consisted of the usual stiff blue or green muds characteristic of continental coasts, here it consists of very soft black oozy mud, characteristic of river estuaries. Between the island of St. Thomas and the French settlement on the Gaboon a very good profile was sounded (see Fig. 3). Here the 500-fathom line was 10 miles, the 1000-fathom line 34 miles, and the 1500-fathom line 67 miles from the 100-fathom line. All the way down the coast as far as Loanda the same gentle gradients and the same very soft river mud were found. It appears that the land *débris* brought down by the Niger and Congo, and by other less important rivers, is collected and concentrated in this district. The prevailing current past the mouth of the Congo is a northerly one, while all along the coast from Cape Palmas to the Niger an easterly current sets. These help to confine the drainage matter of both rivers to a comparatively small extent of littoral. If from the

soundings west of Cape St. Paul we compute the mean continental slope, we find that the 500-fathom line is at a mean distance of 4.1 miles, the 1000-fathom at 11.7 miles, and the 1500-fathom line at a distance of 17 miles from the 100-fathom line (line AD, in Fig. 3). If it is assumed that in the absence of the Niger and the Congo the continental slope would be much the same as the average found in the profiles west of Cape St. Paul, it may be concluded that the excess of mud forming the flatter talus along the coasts affected by these rivers, is due to the mud brought down by them. Taking the figures given above, the sectional area of this excess-talus ABC is 60 square nautical miles, and it extends for a distance of at least 1100 miles along the coast. This represents a deposit of 66,000 cubic miles of detritus due principally to the Niger and Congo. The drainage areas of these two rivers are roughly:—of the Niger, 750,000, and of the Congo 1,150,000 square nautical miles, making together 1,900,000 square nautical miles. The 66,000 cubic miles of detritus spread over this area would cover it to a thickness of 200 feet.

Along the Guinea Coast as far as Cape St. Paul the 100-fathom line is at an average distance of 15 miles from the shore; and on the south-west coast between the Niger and the Congo it is from 30 to 40 miles from the shore. At three localities there are remarkable exceptions. Off Grand Bassan the 100-fathom line approaches within a quarter of a mile of the shore, and the curving-in shorewards of the contour lines produces the very remarkable submarine gully known by the name of the "Bottomless Pit." From the *Buccaneer* five lines of soundings were run across it at distances of two miles between the lines. At one mile from the shore the width of the gully is under a mile, with a depth of 150 fathoms; at eight miles from the shore its width is $1\frac{1}{2}$ miles, with a maximum observed depth of 327 fathoms; while two miles further seawards its width has increased to 4 miles, with a maximum observed depth of 452 fathoms. The accompanying sketch-plan (Fig. 1) of the contour lines gives a better idea of this extraordinary feature than can be conveyed by description. The bottom consisted everywhere of a soft dark-coloured mud, and the slopes of the sides averaged in many places 2000 feet per mile.

Another similar gully occurs to the eastward of Lagos, called Avon's Deep, but it does not reach so close to the shore as the one just described.

The most remarkable feature of this kind occurs at the mouth of the river Congo (Fig. 2). Here the gully penetrates inland up the river, a depth of 150 fathoms being found 20 miles within its mouth, while it was traced by the *Buccaneer* to a distance of nearly 100 miles seaward. It forms an immense submarine cañon, with steep mud sides, penetrating deeply into the land. The 100-fathom line runs at a distance of about 35 miles from the coast both north and south of the cañon; the 500-fathom line runs at about 60 miles, and the 1000-fathom line at about 80 miles from the coast. Of these contour lines, that of 100 fathoms penetrates 20

miles within the coast line, that of 500 reaches to within 10 miles, and that of 1000 fathoms to within 50 miles of it. At the mouth of the river, off Shark Point, the width of the gully is three miles, and the deepest sounding was 333 fathoms. The deepest sounding obtained in the river, off Banana Creek, was 242 fathoms. Thirty-five miles off the mouth of the river the width of the gully is six miles, and the maximum depth observed was 573 fathoms. The bottom of the cañon is here 3000 feet below the surface of the plateau in which it is cut.

It is difficult to furnish a satisfactory explanation of these gullies, but the Congo cañon is certainly connected with the river which flows over it, and the "Bottomless Pit" may be connected with the river Akba, which flows into the sea a few miles to the eastward of it. The Congo cañon is not due to erosion by the river, for the current, strong though it is, does not extend more than 20 fathoms from the surface, and is felt to a considerable distance out to sea, where it thins out considerably. For many miles off the mouth of the river the water has a dark reddish-yellow colour, but this forms only a thin layer, as the ship's propeller turns up the colourless salt water beneath. The existence and the persistence of the cañon are due to an agency which prevents the mud brought down by the river being deposited along its axis. This agency is probably the sea water running up the gully at the bottom and returning in the upper layers, mixed with the river water. A circulation in a vertical plane is thus produced, and in the axis of it, settlement of sediment is more difficult than on either side of it. The bottom of the cañon, or gully, would thus resemble more nearly the original form of the bottom of the sea before the Congo discharged its waves into it, than the flatter and shallower bottom on each side of it. In fact the cañon has been built up, not hollowed out. In how far a crack in the crust of the earth may have had to do with the depth or the position of this cañon, it is impossible to speak certainly, but the preservation and accentuation of it are certainly due to the prevention of the deposition of sediment.

The "Bottomless Pit" is situated only fourteen miles from the mouth of the large river Akba. As is usual on this coast, behind the beach of pebbles, heaped up and arranged by the combined action of the surf and the prevailing easterly current, there is an extensive lagoon formation connected with the river; and at the point where the "Bottomless Pit" approaches nearest to the beach, the width of the beach separating the lagoon from the sea is smallest, being little over a quarter of a mile. The mouths of these rivers frequently change their positions, and it is not improbable that the Akba may have entered the sea where the "Bottomless Pit" now is, and produced similar conditions to those existing at the mouth of the Congo. Since the date of the *Buccaneer's* visit, the lagoon at Porto Novo has opened a new communication with the sea.

In Europe, at the head of the Bay of Biscay, and on a coast resembling in some of its physical features the coast of the Gulf of Guinea, a gully or cañon quite like the Bottomless Pit penetrates close up to the shore

at Cape Breton, where, in former times, the river Adour entered the sea. This remarkable gully forms a deep indentation in the littoral flat, and runs parallel with the range of the Pyrenees and the mountains of the north coast of Spain. It is not impossible that, in their origin, these two features may have had some connection with each other. Much trouble was experienced with the first cable laid from Bilbao over the deeper part of this gully, indicating some instability in the features of the bottom in this region, even at depths of over 1000 fathoms. Earthquakes are a frequent cause of rupture of cables in the neighbourhood of the steep slopes connecting the continents with the ocean beds.

The nature of the circulation of the water at the mouth of a deep river like the Congo will be better understood if we imagine for a moment a barrier across its mouth at Shark Point, and the whole of the bed of the river above it filled with fresh river-water. The depth of the channel both above and below the barrier is between 200 and 300 fathoms. On the seaward side the water is salt, with a density of, say, 1.023, as compared with that of the water inside, which is unity: that is, a column of the outside water 1000 feet high would balance one of the inside water 1023 feet high. If the barrier be now removed there will be an immediate rush of the denser water inwards to occupy the lower part of the bed of the river, and a rush outwards of the fresh water to occupy the surface layers of the sea outside. If the barrier be now re-established, although it might take some considerable time to clean out the last vestige of salt water from the deepest parts of the inner bed, it would not take long to eliminate enough of the salt water to establish a very decided difference of density on the two sides of the barrier. On its removal again a similar redistribution of the waters would take place, the denser sea-water going to the deeper parts of the river-bed, and the fresher water going to the surface of the ocean. Now these operations, which we have here imagined to take place *per saltum*, go on continuously in nature. The constant supply of fresh water from the river produces a constant difference between the weight of a column of water at the upper part of its estuary, and that of an equal column at the lower part of its estuary. This difference may, and probably will, fluctuate in amount, but it will be always in favour of the seaward column, and against the landward one. It finds its natural balance in an under-current from the heavier column to the lighter one. A very good example of this kind of circulation is afforded by the well-known currents of the Bosphorus. These are due to the surplus water, supplied to the Black Sea by rain and rivers, over that removed by evaporation from its surface, which finds its outlet at the Bosphorus into the waters of the Mediterranean. Here the conditions are reversed, the evaporation from the Mediterranean much exceeding the supply by rain and rivers, including that derived from the Black Sea. If a barrier were erected at the Bosphorus so as to admit of the waters on each side attaining their natural density, exactly the

same phenomena would be observed on its removal as have been described above when considering the case of the Congo.

At the Straits of Gibraltar we have a curious instance of a similar phenomenon; here, however, the Atlantic Ocean performs the part of the river, while the Mediterranean is the receiving ocean-bed, kept at a constantly lower level by the evaporation from its surface.

COAST FLATS.—Hitherto we have considered only the slopes at greater depths than 100 fathoms. A few words may be said about the slopes between the beach and the 100-fathom line.

TABLE I.—Profiles of Coast Flats.

Number, of Profile.	1	2	3	4	5	6	7	8	9	10	11
Longitude,	9° W.	8°	7°	8°	3° 30'	1°	0°	0° 55' E.	1°	3° E.	
Depth, Fathoms.	Distance of Depth from shore in nautical miles.										
10	1·5	1·2	0·7	2·0	1·0	2·5	2·2	7·0	1·0	3·5	1
20	3·0	5·5	2·0	5·5	3·0	16·0	4·0		4·0	7·5	4
30	5·5	6·5	5·0	9·5	6·5	31·0	10·0		5·5	10·0	6·5
40	13·0	8·0	8·0	10·0	9·5	35·0	12·8			12·5	9
50	20·5	12·5	12·0	16·5	13·0	37·0	13·8			13·5	13·5
60	22·0	14·0	13·0		13·5	38·0					14
70	23·0										
80	24·0										
90	24·5										
100	25·5	15·0	14·0	17·0	14·0	39·0	15·0	8·0	6·5	14·5	15

In Table I. are given the distances in nautical miles from the shore at which certain depths are found, on lines of profiles between long. 9° W. and long. 3° E. It will be observed that only at the first locality, in long. 9° W., a little to the west of Cape Palmas, was it possible to find the locality of the depths between 60 and 100 fathoms. At this station there is a remarkable projection of the 100-fathom line seaward, which is found repeated in the contour lines of greater depths. Judging from the observations of bottom temperature, it is probable that the contour lines of 1800 fathoms run across to the Ascension plateau. At all the other localities, when a depth of 60, or even 40 or 50, fathoms has been found, the edge of the slope from continent to ocean has been reached. No. 6 represents soundings on the great flat stretching from Cape Three Points, where the 100-fathom line is nearly 40 miles from the coast. At Cape St. Paul there is a curious configuration of the shore flat. On the west

side of it (No. 8), a depth of under 10 fathoms is found to a distance of 7 miles from the shore, and then in another mile the depth is over 100 fathoms. On the east side of it (No. 9) the slope is only very little less abrupt, and 100 fathoms is found within 7 miles of the coast. These are exceptional cases, and Nos. 2, 3, 4, 5, 7, and 10 represent the normal configurations of the coast flat as it is met with in this part of the world. In Column No. 11 we have the means of the distances found in Nos. 2, 3, 4, and 5, which all lie on the coast between Cape Palmas and Cape Three Points. On this coast the beach, consisting, as it does, almost invariably of shingle, is always "steep to," so that, at a distance of a few yards from it, there is usually a depth of four or five fathoms; the gentle slope then commences. With a depth of 10 fathoms at 1 mile from the shore, we have to go 4 miles before the water deepens by another 10 fathoms to 20 fathoms, 2.5 miles further to get 30, 2.5 miles further to get 40 fathoms, and 4.5 miles to get 50 fathoms. A mile further we have 60 fathoms, when the rapid descent begins, and in another mile we have over 100 fathoms. We may say, then, that on the Guinea Coast the littoral flat extends to a distance of about 14 miles from the shore, and to a depth of 50 fathoms.

This coast flat represents the gain of the sea on the land. We may suppose that originally the average slope between the coast-line and a depth of 100 fathoms was not very different from that between 100 and 200 fathoms. The retreat of the coast-line is due to the wearing action of the waves, charged with the *débris* of the already disintegrated land. To a certain extent, therefore, the depths to which the coast has been cut back from the 100-fathom line indicates the work done by the waves since the continent and ocean attained their present relative positions.

Fig. 6 represents some sections in profile of coast flats on the Guinea Coast, Nos. 1, 10, and 11, and for comparison some from the North Atlantic, Nos. 12, 13, and 14. These profiles meet at 100 fathoms, which is the common depth from which they are all drawn.

Of the Guinea Coast profiles, No. 10 represents the coast flat east of Cape St. Paul in long. 3° E., No. 11 is constructed from the mean of four profiles between Cape Palmas and Cape Three Points, and No. 1 is the profile at the point, west of Cape Palmas, where not only the 100-fathom lines extend further from the coast, but where, even at greater depths, the slopes are comparatively slight. In the cases of Nos. 10 and 11 it is evident that the wear-and-tear at depths greater than 50 fathoms is insignificant. The same holds with regard to No. 1; the part of the profile below 50 fathoms properly belongs to the continental slope, which is here exceptionally gentle. Turning now to the North Atlantic profiles, No. 12 is drawn from Cape Ferret, in lat. 44° 40' N.; No. 13, from the Saint Islands, a little south of Ushant; and No. 14 from Mizen Head, on the south-west coast of Ireland. They afford, therefore, examples of the formation of the coast flat on the stormiest coast of the world. The

effect is evident in the great distance, both horizontally and vertically, to which the waves have hollowed out the land.

In the Gulf of Guinea there may be said to be practically no wind. The surf which breaks on the beaches is due to waves produced by the storms of much higher latitudes, which travel as long low swells, which show no signs of breaking until close to the shore, in a depth of not more than three or four fathoms. Here their power is very apparent, and the surf which they produce is the greatest hindrance to communication with the coast. In deeper water their power is very slight.

On the other hand, the conditions at the entrance to the English Channel and in the Bay of Biscay are very different. In no part of the world are the storms more frequent, more violent, and of greater duration than in this part of the North Atlantic. They blow with their greatest violence while veering from SW. through W. to NW. The waves are produced in very deep water, where there is nothing to prevent their attaining any size proportioned to the power of the wind. They are then driven on the lee shores of Ireland, England, and France, not as swells, but as storm waves, still driven by the tempest which produced them. The result is apparent in the great distance inland and depth vertically to which they have carried their hollowing action. Off Mizen Head the wearing action is strong at 100 fathoms; off Saint Islands it is very apparent at 100, and strong at 90 fathoms, while off Cape Ferret it is hardly sensible at 100 fathoms, and only becomes strong in depths under 80 fathoms. Cape Ferret lies on the French coast in the southern part of the Bay of Biscay, and does not experience the full strength of the waves until the wind has passed from S.W. to W. This means that, for the first part of the duration of the storm, this coast is sheltered; the resulting wearing action is therefore by so much less evident. If we assume, as, in absence of evidence to the contrary, we have a right to assume, that there is no differential motion of the African and European continent with respect to the sea-level, the sectional area enclosed by these profiles and the sea surface represents approximately the work done by the sea on the land in calm and in stormy latitudes.

In Tables II., III., and IV. are given some figures deduced from the profiles. The total sectional area considered in any one case is that enclosed by the concavity of the profile, the surface line, and the vertical line from the surface line to the bottom in a depth of 100 fathoms. This area is subdivided into ten successive areas corresponding to the ten intervals of ten fathoms between the surface and 100 fathoms. In Table II. the mean horizontal distance, in nautical miles, to which each 10-fathom band has been cut into the land is given for each profile. In Table III. the proportion (per cent.) of the area of each 10-fathom band to the whole sectional area removed is given for each profile. In Table IV. the summations of these percentages are given for each profile. These give the areas of the bands from 100 fathoms to each tenth fathom in percentage of the whole area removed.

TABLE II., giving the mean horizontal distance, in nautical miles, to which each 10-fathom band has been cut into the land for each profile.

Pro- file No.	MEAN DISTANCES FOR THE DEPTH-INTERVALS.									
	100-90	90-80	80-70	70-60	60-50	50-40	40-30	30-20	20-10	10-0
1	0.4	1.2	2.0	3.0	4.0	8.0	16.6	21.6	23.0	25.0
11	0.4	1.0	1.6	2.2	2.7	6.4	14.2	18.1	24.2	29.2
10	0.1	0.3	0.5	0.7	0.9	1.4	3.1	5.7	9.0	13.1
12	0.5	1.5	4.0	11.5	15.8	20.2	24.3	27.5	31.0	34.4
13	8.0	19.8	27.8	32.5	36.0	39.3	43.5	47.0	48.6	48.9
14	2.0	7.8	22.4	39.3	50.0	55.0	58.5	60.7	61.5	61.9

These distances are given in nautical miles of 1000 fathoms each, and, when multiplied by 0.01' (= 10 fathoms) they give the area of each section in terms of a square nautical mile of 1000 fathoms. In other words, the figures under the depth-intervals in A. give the areas of the sections if the decimal point be shifted two places to the left. In the last column, where the depth interval is 100 fathoms, the point must be shifted only one point to the left.

TABLE III., giving the proportion (per cent.) of the area of each 10-fathom band to the whole sectional area removed.

Pro- file No.	PERCENTAGE OF AREA REMOVED FOR DEPTH-INTERVALS.									
	100-90	90-80	80-70	70-60	60-50	50-40	40-30	30-20	20-10	10-0
1	0.4	1.2	2.0	2.9	3.9	7.8	15.6	20.6	21.8	23.8
11	0.4	1.0	1.6	2.2	2.7	6.4	14.2	18.1	24.2	29.2
10	0.3	0.9	1.5	2.1	2.8	4.0	9.0	16.3	25.6	37.6
12	0.2	1.0	2.2	6.8	9.3	12.0	14.2	16.2	18.0	20.1
13	2.3	5.8	8.0	9.3	10.2	11.0	12.3	13.4	13.8	13.9
14	0.4	1.9	5.4	9.6	12.0	13.0	13.8	14.5	14.7	14.8

TABLE IV., giving the areas of the bands from 100 fathoms to each tenth fathom in percentage of the whole area removed.

Pro- file No.	AREA REMOVED BETWEEN 100 FATHOMS AND FOLLOWING DEPTHS :—									
	90	80	70	60	50	40	30	20	10	0
1	0.4	1.6	3.6	6.5	10.4	18.2	33.8	54.4	76.2	100.0
11	0.4	1.4	3.0	5.2	7.9	14.3	28.5	46.6	70.8	100.0
10	0.3	1.2	2.7	4.8	7.6	11.6	20.6	36.9	62.4	100.0
12	0.2	1.2	3.4	10.2	19.5	31.5	45.7	61.9	79.9	100.0
13	2.3	8.1	16.1	25.4	35.6	46.6	58.9	72.3	86.1	100.0
14	0.4	2.3	7.7	17.2	29.2	42.2	56.0	70.5	85.2	100.0

From this table it will be seen that between 50 and 100 fathoms there is less than 10 per cent. removed on the Guinea Coast, while as much as 35 per cent. has been removed on the Irish coast. On the Guinea Coast between 70 and 80 per cent. has been removed between the shore and a depth of 30 fathoms; in fact, the seas of these latitudes have hardly any action at depths greater than 30 fathoms. On the North Atlantic coast, the slope to 90 fathoms is much like the slope to 10 fathoms on the Guinea Coast, and from 50 to 60 per cent. of the whole wear-and-tear has taken place at depths greater than 30 fathoms.

The absolute amounts of the land removed at the different depths are interesting. In the following table the sectional areas removed at different depth-intervals are given in square nautical miles:—

TABLE V.

Depth-Interval.	Sectional Area Removed. (Square Nautical Miles.)					
	No. 1.	No. 11.	No. 10.	No. 12.	No. 13.	No. 14.
0 and 10 fathoms, . . .	0·250	0·150	0·131	0·344	0·489	0·619
0 „ 30 „ . . .	0·696	0·367	0·278	0·949	1·445	1·841
30 „ 50 „ . . .	0·246	0·106	0·045	0·445	0·828	1·135
50 „ 100 „ . . .	0·106	0·040	0·025	0·333	1·241	1·215
0 „ 100 „ . . .	1·048	0·513	0·348	1·707	3·514	4·191

If we take the mean of Nos. 1, 11, and 10, we have 0·636 square nautical mile for the mean sectional area removed on the Guinea Coast, and similarly, from Nos. 12, 13, and 14, we have 3·137 square miles as the mean sectional area removed from the North Atlantic coast, between the shore and a depth of 100 fathoms.

If we assume that in the absence of wave-action the true continental slope in this interval would have been at the rate of 100 fathoms per mile, we should have to deduct from the above figures 0·1 square mile as the sectional area of the continental slope, and the mean sectional areas would stand as 0·536 and 3·037. Roughly, therefore, we may say that during the time the European and African continents have maintained their present level relatively to the ocean, the strong waves of the North Atlantic have disintegrated and removed over five times more land from the western shores of Britain and France than the calm equatorial waters have been able to remove from the Guinea Coast.

Further, the study of the conformation of the sea-bottom between the shore and a depth of 100 fathoms affords the most convincing evidence,

that, for the time required to remove those masses of land the relative positions of the continent and the ocean *have* remained practically constant. It is not impossible that the terraced formation, observed at depths over 100 fathoms along most continental edges where soundings have been taken sufficiently closely to one another, may be the remains of former coast flats which have sunk in the course of the cooling of the earth. A very remarkable terrace of this kind is found running for a considerable distance along the western part of the Guinea Coast, at a depth of from 600 to 700 fathoms from the surface. This, however, is a subject of too difficult a character to be discussed at the end of a paper like the present.

APPENDIX.

DETAILS OF PROFILES ON WEST COAST OF AFRICA, WITH REMARKS.

No. of Sounding.	Profile.	Direction of Profile (true).	Latitude.	Longitude.	Depth, Fathoms.	Distance, Nautical Miles.	Gradient, Fathoms per mile.	Remarks.
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	
4	A	...	7 33 N.	15 18W	2406	...	...	Fig. 4.
5	"	N. 73° E.	7 38	14 59	2246	19.5	8.2	
6	"	"	7 41	14 51	2181	8.4	7.7	Flat
7	"	"	7 44	14 41	1991	10.0	19	
8	"	"	7 45	14 35	1911	6.0	18	F at
9	"	"	7 46	14 31	1764	4.0	41	Steep
10	"	"	7 47.1	14 26.8	1590	4.5	35	
11	"	"	7 47.9	14 23.6	1369	3.0	73	
12	"	"	7 48.5	14 21.5	1226	2.0	72	
13	"	N. 106° E.	7 48.2	14 19	922	2.5	122	Steep
14	"	"	7 48	14 16.4	706	2.5	86	
15	"	"	7 47.9	14 13.6	656	2.7	18	Flat
16	"	"	7 47.6	14 11	376	2.5	112	
17	"	"	7 47.4	14 8.4	197	2.5	72	Steep
18	"	"	7 47.3	14 5.7	52	2.5	58	
21	B	...	7 20	13 26	45	...	...	
22	"	N.	7 18	13 26	192	2.0	...	
23	"	"	7 17	13 26	357	1.0	165	Steep
24	"	"	7 14	13 26	609	3.2	79	
25	"	"	7 12	13 27	698	0.8	52	Flat
26	"	"	7 10	13 27	890	2.0	87	
27	"	"	7 8	13 27	1091	2.0	105	Steep
28	"	"	7 1	13 25	1817	7.0	104	"
33	C	...	6 34	12 39	1824	...	...	
34	"	N. 24° E.	6 36	12 38	1798	2.3	11	
35	"	"	6 38	12 37	1773	2.3	11	Flat
36	"	"	6 47	12 33	1604	9.9	16	
37	"	"	6 48.5	12 32	1510	1.8	52	Steep
38	"	N. 36° E.	6 51	12 30	1417	3.1	30	Flat
39	"	"	6 53.5	12 28.5	1317	3.0	33	"
40	"	"	6 56	12 27	1026	2.9	100	Steep
41	"	"	6 58.5	12 25	833	3.2	60	Flat
42	"	"	7 1	12 23.5	658	2.9	60	"
43	"	"	7 3	12 22	160	2.6	192	Steep

No. of Sounding.	Profile.	Direction of Profile (true).	Latitude.	Longitude.	Depth, Fathoms.	Distance, Nautical Miles.	Gradient, Fathoms per mile.	Remarks.
a	b	c	d	e	f	g	h	
51	D	...	6 8 N	10 55 W.	68	...	...	Fig. 4.
52	"	N.	6 7	10 55	199	1.0	131	Steep
53	"	N. 42° E.	6 6	10 55.5	256	1.0	57	
54	"	"	6 4.5	10 57.5	392	2.5	54	
55	"	"	6 3	10 58	442	1.5	34	Flat
56	"	"	6 1	11 0	560	2.9	41	Steep
57	"	"	5 58.5	11 2.5	661	3.6	28	Flat
58	"	"	5 56.5	11 4.5	782	2.7	45	
59	"	"	5 52.5	11 8	1103	5.2	62	Steep
67	E	...	4 21.5	9 8.3	556	...	...	
68	"	N. 41° E.	4 23.4	9 6.3	366	2.6	73	Steep
69	"	"	4 26	9 4.4	264	3.3	31	
70	"	"	4 28	9 2.4	188	2.7	28	
71	"	"	4 30.1	9 0.4	102	3.1	28	Flat
...	F	...	...	...	100	...	...	From Chart
79	"	N.	4 7.7	7 42.5	357	1.6	161	Steep
80	"	"	3 57.2	7 42.8	1567	9.6	127	
81	"	"	3 46.8	7 42.9	2010	9.6	46	Fig. 4
82	"	"	3 0.8	7 43	2546	46.0	12	
88	G	...	4 39.7	6 7.1	61	...	...	
89	"	N. 27° W.	4 37.7	6 6.5	234	2.2	79	
90	"	"	4 36.1	6 6.7	457	1.2	186	Steep
91	"	"	4 35.6	6 6	611	0.9	171	
92	"	"	4 33.2	6 5.5	944	2.2	151	
93	"	"	4 31.6	6 4.4	1123	2.0	90	
94	"	"	4 27.3	6 1.9	1327	4.8	43	
95	"	"	4 22.9	5 59.5	1513	5.0	37	
96	"	"	4 14.2	5 54.8	1643	10.0	13	
97	"	"	4 5.6	5 49.9	1817	9.9	18	Steep
128	K	...	3 58	3 42	1886	...	...	
129	"	N. 9° E.	4 7.6	3 40.7	1794	9.8	9	
130	"	"	4 27.4	3 37.5	1234	16.0	35	
131	"	"	4 32.1	3 36.5	1093	9.3	15	
132	"	"	4 37	3 35.5	916	4.8	37	Flat
...	L	...	...	...	100	...	...	From Chart
141	"	N. 40° W.	4 19.1	1 4.9	434	1.7	197	Fig. 4
142	"	"	4 17.3	1 3.4	1083	2.8	232	
143	"	"	4 15.7	1 2	1727	2.0	322	Steep
144	"	"	4 14.3	0 59.6	1973	2.7	91	
145	M	...	5 15.5	0 13 E.	1431	...	...	
146	"	N. 17° W.	5 17.6	0 13.2	1282	2.0	75	
147	"	"	5 22.3	0 11.6	868	5.3	78	
148	"	"	5 26.5	0 9.9	362	4.2	120	
149	"	"	5 28.4	0 9.6	107	2.0	128	Steep
150	N	...	5 22.4	0 1.5 W	35	...	...	
151	"	N 56° W.	5 20.3	0 0.7 E.	166	3.2	41	
152	"	"	5 18.8	0 2.5	565	2.2	181	Steep
154	"	"	5 16.1	0 7.4	1041	5.7	84	Flat
155	"	"	5 14.7	0 9.8	1311	2.8	96	Steep
156	"	"	5 13.3	0 12.2	1488	2.9	61	

No. of Sounding.	Profile.	Direction of Profile (true).	Latitude.	Longitude.	Depth, Fathoms.	Distance, Nautical Miles.	Gradient, Fathoms per Mile.	Remarks.
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	
162	P	...	5 35.5 N.	1 11.1 E.	1132	...	...	
163	"	N. 45° W.	5 37.5	1 9.3	999	2.8	47	
164	"	"	5 39.6	1 7.4	847	2.7	56	
165	"	"	5 41.8	1 5.3	635	3.0	69	
166	"	"	5 42.9	1 3.2	366	2.2	122	Steep
176	R	...	5 54.8	2 8.9	1105	...	...	
177	"	N. 13° E.	5 59	2 9.8	651	4.2	108	Steep
178	"	"	6 0.6	2 10.2	543	1.9	57	
179	"	"	6 2.2	2 10.5	449	1.5	63	Flat
180	"	"	6 4.3	2 11	168	2.2	128	Steep
181	S	...	6 5	2 45	418	...	...	
182	"	N. 26° W.	6 3.3	2 46	591	2.0	86	Steep
183	"	"	6 1.4	2 46.8	761	2.2	77	Flat
184	"	"	5 58.2	2 47.7	1084	3.2	101	Steep
185	"	"	5 49.8	2 52.2	1434	9.5	37	
186	"	"	5 41.1	2 56.3	1625	9.5	20	
249	T	...	0 22.3	8 52.2	65	...	...	
250	"	W.	0 22.3	8 50.4	165	2.2	45	
251	"	"	0 22.3	8 49.8	214	0.6	82	Steep
252	"	"	0 22.5	8 48.6	237	1.3	17	Flat
253	"	"	0 22.8	8 47.5	298	1.0	61	
254	"	"	0 22.8	8 41.5	465	6.0	28	
255	"	"	0 22.8	8 33.2	660	8.3	23	
256	"	"	0 22.8	8 25	825	8.2	20	
257	"	"	0 22.8	8 16.7	1096	8.3	33	
258	"	"	0 22.4	7 59.8	1367	16.9	16	
259	"	"	0 22.1	7 42.9	1532	16.9	10	
289	V	...	1 22.2 S.	7 45	1396	...	...	
288	"	N. 60° E.	1 12.4	7 55.8	1138	14.0	18	
290	"	"	1 6.2	8 10.4	757	15.6	24	
291	"	"	1 1.2	8 19.7	342	9.8	42	
376	W	...	5 10.5	11 38.7	168	...	...	
377	"	W.	5 10.3	11 29.2	206	9.5	4	
378	"	"	5 10.1	11 19.8	474	9.4	29	
379	"	"	5 9.8	11 10.4	737	9.4	28	
380	"	"	5 9.6	11 1	903	9.4	18	
381	"	"	5 9	10 43	1093	18.0	11	
219	X	...	0 25.3 N.	6 38.7	26	...	...	S. Thomas
221	"	N.	0 25.7	6 38.7	110	0.4	210	
220	"	"	0 26.1	6 38.7	201	0.4	228	
222	"	"	0 26.5	6 38.7	458	0.4	642	Steep
223	"	"	0 27.4	6 38.8	780	0.9	358	
266	Y	...	0 20.1	6 45.6	150	...	...	S. Thomas
265	"	N. 87° E.	0 21.1	6 46.5	391	0.9	268	Projected on line
267	"	"	0 20.2	6 47.7	737	1.2	288	
268	"	"	0 20.3	6 48.8	933	1.1	178	
269	"	"	0 20.4	6 52.2	1256	3.4	95	

No. of Sounding.	Profile.	Direction of Profile (true).	Latitude.	Longitude.	Depth, Fathoms.	Distance, Nautical Miles.	Gradient, Fathoms per Mile.	Remarks.
a	b	c	d	e	f	g	h	
275	Z	...	0 22.3 N.	6 44.7 E.	18	...	...	S. Thomas
274	"	N. 42° E.	0 23.3	6 45.6	519	1.3	385	
273	"	"	0 24.2	6 46.2	957	1.1	398	
272	"	"	0 25.6	6 47.4	1384	2.0	214	
276	Φ	...	0 17.9	6 46.8	201	...	...	S. Thomas
277	"	N. 99° E.	0 17.7	6 47.4	557	0.5	712	
278	"	"	0 17.5	6 48.6	889	1.2	277	
279	"	"	0 17.4	6 49.8	1017	1.2	107	
280	"	"	0 17.0	6 52.7	1282	3.0	88	
238	Ψ	...	1 37.3	7 30.2	117	...	...	Prince's Island Steep
240	"	N. 90° E.	1 37.4	7 30.5	309	0.3	640	
239	"	"	1 37.3	7 31.0	561	0.5	504	Flat Steep
241	"	"	1 37.3	7 31.3	599	0.3	127	
242	"	N. 117° E.	1 36.9	7 32.4	887	1.2	240	
243	"	"	1 36.2	7 33.7	1092	1.4	146	

Profile A., off Sierra Leone, starts from a depth of 2406 fathoms in lat. $7^{\circ} 33'$ N., long. $15^{\circ} 18'$ W., and runs N. 73° E. for 60 miles to a position in lat. $7^{\circ} 48' 5''$ N., long. $14^{\circ} 21' 5''$ W., where the depth was 1226 fathoms. From here it runs N. 106° E. for 16 miles, to a position in lat. $7^{\circ} 47' 3''$ N., long. $14^{\circ} 5' 7''$ W., where the depth was 52 fathoms. From here to the 10-fathom line off St. Anne's Shoals is 26 miles. At this point the coast-line alters its trend considerably to the eastward, but the 100-fathom line runs from Bijuga Islands to Cape Palmas pretty constantly in a S.E. by E. direction. The profile is therefore not normal to the 100-fathom line, but is nearly so to the coast-line at Sierra Leone. This profile starts from the greatest depth, and runs for a distance of 28 miles inshore, shoaling only at the rate of 8 fathoms per mile. Between depths of 2200 and 2000 fathoms the rate of shoaling is doubled, rising to 19 fathoms per mile, and it falls off again slightly to 13 fathoms per mile between 2000 fathoms and 1900 fathoms. From this depth until 900 fathoms the rate of shoaling increases from 35 fathoms per mile to 122 fathoms per mile. Between 900 and 650 fathoms it falls off to as low as 18 fathoms per mile, increasing again to 112 fathoms per mile between 400 and 300 fathoms, and falling off again to 58 fathoms per mile between 150 and 50 fathoms. The average slope on the 26 miles of coast flat between the depth of 50 and 10 fathoms is only 1.6 fathoms per mile.

In this profile we have three maxima of steepness, occurring between 350 and 650 fathoms, between 900 and 1200 fathoms, and between 2000 and 2200 fathoms. A very marked terrace-flat occurs between 650 and 700 fathoms, and a deeper one between 1900 and 2000 fathoms. We find from the above data that our line of profile is cut by the contour line of 500 fathoms at 5.3 miles from the 100-fathom line, by that of 1000 fathoms at 13 miles, by that of 1500 fathoms at 19 miles, and by that of 2000 fathoms at 36 miles from the same line. Assuming that these contours are approximately parallel to that of 100

fathoms, their perpendicular distance from that line would be—500 fathoms, 4 miles; 1000 fathoms, 10 miles; 1500 fathoms, 14 miles; and 2000 fathoms, 25 miles.

Profile B., on the southern flank of St. Anne's Shoals, was intended to be on a meridian, and it is sufficiently nearly so to justify the soundings being projected on a meridian. The slight deviations in the position of the actual soundings were caused by the strong easterly current which prevailed. The line extends from a position in lat. $7^{\circ} 1' N.$, long. $13^{\circ} 25' W.$, where the depth was 1817 fathoms, to a position in lat. $7^{\circ} 20' N.$, long. $13^{\circ} 26' W.$, with a depth of 45 fathoms. The length of the line is thus only 19 miles, and the depth increases after leaving the coast flat at an average rate of over 100 fathoms per mile. The maximum slope is between 200 and 350 fathoms, where it is as much as 165 fathoms per mile. This, no doubt, corresponds to the maximum slope between 350 and 650 fathoms in Profile A.; also the comparative flat found here between 600 and 700 fathoms corresponds to the similar one found at A. between 650 and 700 fathoms, though it is less pronounced. The great steepness between 900 and 1800 fathoms is remarkable—105 fathoms per mile—as compared with 68 fathoms per mile in the same interval at A. The distance of the principal contour lines from that of 100 fathoms is—500 fathoms, 3.6 miles; 1000 fathoms, 9.7 miles; and 1500 fathoms, 14.7 miles. If we include the sounding in 2107 fathoms at lat. $6^{\circ} 49' N.$, long. $13^{\circ} 33' W.$, we see that the ground flattens out greatly, and the 2000-fathom line will be at a distance of about 22 miles from the 100-fathom line. It will be seen that these distances are less than those found at A., though they approximate to the projected distances estimated.

Profile C., off the Liberian coast, extends from a position in lat. $6^{\circ} 34' N.$, long. $12^{\circ} 39' W.$, with a depth of 1824 fathoms for 14.5 miles in a $N. 24^{\circ} E.$ direction, to a position in lat. $6^{\circ} 47' N.$, long. $12^{\circ} 33' W.$, with a depth of 1604 fathoms; then for a distance of 19.5 miles in a $N. 36^{\circ} E.$ direction to a position in lat. $7^{\circ} 3' N.$, long. $12^{\circ} 22' W.$, with a depth of 160 fathoms. A remarkable feature of this profile is the excessive steepness of the ground at a depth of 100 to 650 fathoms. Between 160 fathoms and 658 fathoms the average rate of increase of depth is 192 fathoms per mile. From 650 to 1000 fathoms the rate is only one-third of this, and apparently fairly uniform, corresponding to the ledge or flat, which was very pronounced at A., less so at B., and here seems merging into a more modified slope. Just as at A. and B. we find a steep slope between 1000 and 1300 fathoms, between 1500 and 1600 fathoms there is again an increase of steepness, and at 1800 fathoms it inclines to get a little steeper.

The distance from the coast to the 100-fathom line is 15 miles, and from this line the 500-fathom line is 2 miles, the 1000-fathom line 8.9 miles, and the 1500-fathom line 18 miles distant. The average slope is therefore steeper at depths from 100 to 1000 fathoms at C. than at B.; at greater depths the reverse is the case.

Profile D., off Cape Mesurado, extends from a position in lat. $5^{\circ} 52' 5'' N.$, long. $11^{\circ} 8' W.$, with a depth of 1103 fathoms for 20 miles in a $N. 41^{\circ} E.$ direction to a position in lat. $6^{\circ} 7' N.$, long. $10^{\circ} 55' W.$, with a depth of 199 fathoms. Some shallower soundings, not exactly on the line, enabled the position of the 100-fathom line to be fixed with tolerable accuracy. This profile is very much less steep than any of the preceding ones. The steepest part is between 100 and 200 fathoms, and there are steep parts between 450 and 550 fathoms, and between 800 and 1100 fathoms. In fact, the features of the previous profiles are still discernible here, though they are much flattened.

The 100-fathom line is 12 miles distant from the coast, and from the 100-

fathom line the contour of 500 fathoms is 7.3 miles, and that of 1000 fathoms 19 miles distant.

Profile E, off the Krou coast, runs in a N. 41° E. direction from a position in lat. $4^{\circ} 21' 5''$ N., long. $9^{\circ} 8' 3''$ W., with a depth of 556 fathoms for a distance of 12 miles to a position in lat. $4^{\circ} 30' 1''$ N., long. $9^{\circ} 0' 4''$ W., with a depth of 102 fathoms. The position chosen for this profile was determined by the existence on the charts of a remarkable widening of the coast flat, producing a cape-like prominence of the 100-fathom line. The soundings on this profile do not agree with those on the Admiralty sheet, but the character of ground revealed by both is the same, and it is probable that the discrepancy is due to the great difficulty of accurately determining the position of soundings in cloudy weather, and out of sight of land and with a powerful current setting along the coast. The *Buccanier's* soundings would tend to show that the 100-fathom prominence is less marked than is shown in the chart, but the gradients shown by both sets of soundings agree, and they are particularly remarkable for the gentle slope which they indicate between 100 fathoms and 400 fathoms—only about 29 fathoms per mile. There is a steep slope between 350 and 550 fathoms, with a comparative flat between 550 and 650 fathoms, followed by a steeper declivity between 700 and 1200 fathoms. The contour lines of 1000 fathoms and 500 fathoms are distant respectively 21.5 miles and 11 miles from that of 100 fathoms, which is distant 25 miles from the coast. Although our soundings tend to reduce the prominence of the 100-fathom line at this point on the coast, they show, when taken along with those between this and the next profile at Cape Palmas, that there is a decided and remarkable shoaling of the water off this part of the coast, as evidenced by the increased distance of the 500-fathom and the 1000-fathom contour line from the coast. Here the 1000-fathom line is 46.5 miles from the coast; 30 miles further east it approaches within 24 miles of it. It then again retires somewhat, only to approach again in the neighbourhood of Cape Palmas, as will be seen from the soundings on Profile F. There are reasons suggested by the higher temperature of the deep bottom water to the eastward of Profile E. as compared with that found to the westward of it, which render it not improbable that further investigations might prove the shoaling here to be not merely local, but part of an important oceanic feature, and might indicate the existence of a ridge with a maximum depth of 1800 or 1900 fathoms connecting the African continent with the great central ridge or plateau on which Ascension is situated.

Profile F, off Cape Palmas, runs in a north and south direction from a position in lat. $3^{\circ} 0' 8''$ N., long. $7^{\circ} 43' 0''$ W., with a depth of 2546 fathoms for a distant of 67 miles to a position in lat. $4^{\circ} 7' 7''$ N., long. $7^{\circ} 42' 5''$ W., with a depth of 357 fathoms. The line of soundings was made, starting with a good departure, from Cape Palmas; the profile between the shore and 357 fathoms is taken from the Admiralty sheet. The most remarkable feature in this profile is the very rapid descent from 100 fathoms to 1500 fathoms, and even 2000 fathoms. From 100 to 1500 fathoms there is an average increase of depth at the rate of 150 fathoms per mile, and, judging from analogy, there can be no doubt that part of the slope must be very much steeper.

The 100-fathom line is at a distance of 13 miles from the coast, and from the 100-fathom line we have the following distances to the principal contour lines—to that of 500 fathoms, 2.5 miles; of 1000 fathoms, 6.8 miles; of 1500 fathoms, 10.6 miles; of 2000 fathoms, 20.8 miles; and of 2500 fathoms, 61.0 miles.

From the position of the 2546-fathom sounding, the ship ran in again towards Cape Palmas, and took up the line of soundings along the coast. The easterly

current was here found to be much less strong than to the westward of Cape Palmas; in fact, there were occasional indications of an eddy current setting to the westward. The steepness of the continental escarpment seems to increase after rounding Cape Palmas; in longitude 7° W., a depth of 1054 fathoms was found at a distance of 11 miles from the coast, and only 3 miles from the 100-fathom line as indicated in the chart.

Profile G. runs from a position in lat. $4^{\circ} 5' 6''$ N., long. $5^{\circ} 49' 9''$ W., with a depth of 1817 for a distance of 38 miles in a N. 27° W. direction to a position in lat. $4^{\circ} 39' 7''$ N., long. $6^{\circ} 7' 1''$ W., with a depth of 61 fathoms. In this profile we again meet with the steep escarpment between 100 and 1000 fathoms, but, whereas at Cape Palmas the steepness continues to a depth of 1500 and even 2000 fathoms, here in the bight the ground flattens out at depths over 1100 fathoms, the slope here between 1100 and 1300 fathoms being less than that between 1500 and 2000 fathoms at Cape Palmas. There is a slight steepening between 1600 and 1800 fathoms, a feature which has been observed at other parts of the coast. The distance of the principal contour lines from the 100-fathom line are as follows:—1500 fathoms, 17.5 miles; 1000 fathoms, 6.5 miles; and 500 fathoms, 3.2 miles. The coast is 15 miles distant from the 100-fathom line. Proceeding eastwards the bottom seemed to continue remarkably even, soundings of 800 to 1000 fathoms being got along a line parallel to that of the coast and at a distance of 20 miles from it.

On 13th January some soundings were taken in profile, to show the slope of the ground in the deeper water in the middle of the bight.

Profile K. was from a position in lat. $3^{\circ} 58'$ N., long. $3^{\circ} 42'$ W., with a depth of 1886 fathoms for a distance of 40 miles in a direction N. 9° E. to a position in lat. $4^{\circ} 37'$ N., long. $3^{\circ} 35' 5''$ W., with a depth of 916 fathoms.

In this profile we have no information about the water of less depth than 900 fathoms, but the configuration between this depth and 1900 fathoms is remarkable. Between 900 and 1100 fathoms the depth increases at the rate of 37 fathoms per mile, after which the ground flattens out so that in 9.3 miles the depth only increases from 1093 to 1234 fathoms, or at the rate of 15.2 fathoms per mile. In the next 15 miles the depth increases at the rate of 35 fathoms per mile, and falls off again to a rate of 9.4 fathoms per mile at depths between 1800 and 1900 fathoms.

The contour line of 1500 fathoms is 41 miles, and that of 1000-fathoms 22 miles from the 100-fathom line, which is 14 miles from the shore. An important result of these profiles is to show that while the 500-fathom and 1000-fathom lines follow closely the direction of the coast-line, the 1500-fathom line keeps an east and west direction across the bight.

Profile L.—From the position of the 916-fathom sounding a course was steered parallel with the coast, soundings being got in from 800 to 500 fathoms, showing that on the western side of Cape Three Points the 500-fathom line lies from 8 to 10 miles from the 100-fathom line. The ship was now steered in so as to make the land at Cape Three Points, and then a profile was run out from it in a south-westerly direction. A sounding was taken in 30 fathoms, which agreed well with those found on the chart. The next sounding gave a depth of 434 fathoms, and then three soundings, at distances little over 2 miles apart, gave depths of 1083, 1727, and 1973 fathoms, giving evidence of declivities steeper even than those found at Cape Palmas.

The position of the 100-fathom line at this point is uncertain, as our 434-fathom sounding falls within it as placed on the chart, and there cannot be any doubt about its position, as it was obtained immediately after getting

a good position by the land. If we assume the same slope to exist between 100 and 400 fathoms as between 400 and 1000 fathoms, the 100-fathom line will pass 1·5 miles inside of our sounding in 434 fathoms. Between 434 fathoms and 1083 fathoms the depth increases at the rate of 232 fathoms per mile, and between 1083 fathoms and 1727 fathoms it increases at the enormous average rate of 322 fathoms per mile. Between 1727 and 1973 fathoms it falls off to the still very considerable rate of 91 fathoms per mile. Assuming the 100-fathom line to have the position above assigned to it, the distance from it to the other contour lines is as follows :—to the 500-fathom line, 1·8 miles ; to the 1000-fathom line, 3·8 miles ; to the 1500-fathom line, 5·3 miles ; and to the 2000-fathom line, 8·9 miles. The 100-fathom line is here 50 miles from the coast. This is the steepest declivity observed on the coast.

A course was now set for a position off Accra, and Profile M. was sounded. Owing to the strong easterly current this profile fell considerably to the eastward of the desired position. It runs from a position in lat. $5^{\circ} 15' 5''$ N., long. $0^{\circ} 13'$ E., with a depth of 1431 fathoms, to a position in lat. $5^{\circ} 28' 4''$ N., long. $0^{\circ} 9' 6''$ E., with a depth of 107 fathoms, the direction being N. 17° W., and the distance between the two positions 13·5 miles. The gradients in this profile, though moderately steep up to 800 fathoms, are a great contrast to those of profile L. The distances from the principal contour lines to the 100-fathom line are—from that of 1500 fathoms, 14·5 miles ; from that of 1000 fathoms, 8·0 miles ; and from that of 500 fathoms, 3·3 miles. The 100-fathom line is 12·5 miles from the coast.

On leaving Accra, profile N. was sounded directly out into deep water. It runs from a position in lat. $5^{\circ} 20' 3''$ N., long. $0^{\circ} 0' 7''$ E., with a depth of 166 fathoms in a S. 54° E. direction for 13·5 miles, to a position in lat. $5^{\circ} 13' 3''$ N., long. $0^{\circ} 12' 2''$ E., with a depth of 1488 fathoms.

This profile is only a few miles west of profile M., which it much resembles, though it is steeper, especially between 100 and 500 fathoms. The distance from the 100-fathom line to the 500-fathom line is 2·4 miles ; to the 1000-fathom line, 7·9 miles ; and to the 1500-fathom line, 14·5 miles.

The next profile, P., off Cape St. Paul, runs from a position in lat. $5^{\circ} 35' 5''$ N., long. $1^{\circ} 11' 1''$ W., with a depth of 1132 fathoms in a N. 45° W. direction for a distance of 11·2 miles, to a position in lat. $5^{\circ} 42' 9''$ N., long. $1^{\circ} 3' 2''$ E., with a depth of 366 fathoms.

This profile again is less steep than M. in the deeper water. From the 100-fathom line to that of 500 fathoms there are 2·6 miles, and to the 1000-fathom one, 9·6 miles. A few miles east of Cape St. Paul the slope seems to be much steeper, following the general law which seems to hold all along this coast, that the eastern slopes of the salient points of land are steeper than the western ones.

The next profile, R., runs from a position in lat. $5^{\circ} 54' 8''$ N., long. $2^{\circ} 8' 9''$ E., with a depth of 1105 fathoms, in a N. 13° E. direction, to a position in lat. $6^{\circ} 4' 3''$ N., long. $2^{\circ} 11'$ E., with a depth of 168 fathoms. From the 100-fathom line that of 500 fathoms is 3·4 miles, and that of 1000 fathoms 10·4 miles distant. The ship steamed in and made the land, taking a fresh departure from Porto Novo towards the island of St. Thomas.

Profile S. gives the slope off Porto Novo, and it will be seen that the gradients are much gentler than in the previous profiles ; and this was to be expected, as we are approaching the head of the bight, into which the Niger and other great rivers pour their waters and the abundant land *débris* borne down by them. The maximum rate of increase of depth, 101 fathoms per mile, is observed between 800 and 1100 fathoms.

Between the coast and the island of St. Thomas the soundings were carried in a direct line S. 34° W., with occasional soundings to the right and left of the line, in order to show the slope of the bottom. For nearly one-half of the way the line runs parallel to the coast, forming the western margin of the delta of the Niger, and at a distance of about 100 miles from it. For the remainder of the route it crosses the mouth of the Bight of Biafra. The bottom is very uniform, both as regards elevation and mineral character. Although there seem to be no steep ridges or valleys, there are some well-marked depressions and elevations which deserve to be noted. A first maximum depth of 1783 was met with in lat. 5° 15' 4" N., long. 3° 10' E., which no doubt indicates the position of the deepest water of the Bight of Beniu, terminating in the Avon's Deep, a gully much resembling the "Bottomless Pit" further west, and cutting deeply into the coast flat off Lagos. Proceeding southwards, the water shoals gradually, to a minimum observed of 1391 fathoms, in lat. 3° 55' 3" N., long. 4° 7' 3" E. It then deepens rather rapidly in the next 25 miles to 1916 fathoms, in lat. 3° 36' 6" N., long. 4° 28' 1" E. This second maximum depth occurs immediately off the principal mouth of the river Niger. The depth now remains remarkably constant between 1800 and 1900 fathoms, a third maximum of about 1970 fathoms occurring 100 miles from St. Thomas. From the soundings obtained the course of the 1500-fathom contour line can be traced very clearly until it bends away into the Bight of Biafra, where it is uncertain whether it embraces or avoids Prince's Island. The soundings between St. Thomas and Prince's Island show that they are separated by water over 1500 fathoms in depth. The 1500-fathom line follows the line of the coast into the Bight of Benin; it then runs out into a point to the north-west of the mouth of the Niger, and to another point to the south-west of it, with a depression between them running up towards the mouth of the river, the so-called Nun entrance.

Profiles T, V, and W, between the Niger and the Congo, show the alteration in the continental slope caused by the *débris* of the great rivers entering the ocean in this neighbourhood.

Profiles X, Y, Z, Φ , and Ψ , are examples of profiles of volcanic islands, and resemble those of the Canary Islands.

CYCLONE IN THE MOZAMBIQUE CHANNEL.

(With Diagrams.)

FAMILIAR though the words "cyclone," "tornado," and "typhoon" are with the general public, every meteorologist knows that authorities differ much upon many points concerning them, and that their courses, dimensions, and even forms, are still a matter of dispute.

The thousands of observations collected by navigators in every sea, and carefully tabulated in such Observatories as those of Washington and London, have not yet sufficed to settle some very conflicting theories upon atmospheric currents. The work of observing goes on actively, and every record carefully made of storms on sea and land is a valuable contribution both to men of science and to practical seamen. From numberless independent and apparently discordant observations, general laws have been observed and rules laid down that now enable seamen "to manœuvre

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with the storm," and to escape its vortex or most violent and dangerous point.

It is happily not often, therefore, that a vessel passes through that dangerous though interesting circlet, and I think it may interest some of your readers to have laid before them extracts from the log of a vessel that passed through the vortex of a cyclone which moved down the African coast in the end of January last.

The vessel—in which I was a passenger—was, fortunately, a British mail steamer—the *Courland*, of the Castle Packets Company—a model sea boat, originally constructed for service in the north seas, and commanded by as cool and experienced a seaman as ever stepped on board a British ship.

We were on our way northwards, from Delagoa Bay to Mozambique. Strong winds from the south were first encountered in the latitude of Delagoa Bay, and these steadily increased in force, remaining at the same time remarkably steady in direction, on our way up the coast. The vessel touched at Inhambane and Chiloane, and it was after leaving the latter port that we began to see we had to face a thoroughly bad cyclone. I have myself served eighteen years at sea, but never remember experiencing more terrific winds, though perhaps I may have seen a heavier sea.

It was generally felt throughout the vessel that the Captain's wise precaution in laying her head off-shore as early as the evening of the 29th, and thus securing abundant sea-room, freed the vessel from a very great danger, if not indeed from risk of destruction. Had she been, during the worst of the storm, in the shallow waters that stretch off the Zambesi's mouth, the seas encountered would have been more confused and broken, and far more harmful, than those which actually broke upon us: the ship would have suffered more damage, and, had the engines failed for however short a time, she would, if "in-shore," probably have become a complete wreck.

But the plain, matter-of-fact language of the vessel's log speaks most eloquently for itself:—

"Left Chiloane at 7 A.M. upon the 29th Jan. Noon.—Strong gale and gusty, with high following sea; ship rolling and lurching heavily. P.M.—Furled all awnings and secured everything for bad weather. 4 P.M.—Strong gale from S.S.W., with very high sea; ship rolling heavily and shipping much water amidsthips. . . .

"8.15 P.M.—Put ship's head to the southward, and engines at half-speed.

"Mid.—Blowing with hurricane violence during the squalls, and terrific sea; heavy and continual rain; ship rolling and pitching heavily, and taking much water on board fore and aft. . . .

"30th Jan., Noon.—Wind and sea increasing, and sky very gloomy and threatening. . . .

"8 P.M.—Blowing a hurricane, with high confused sea. Ship pitching and rolling heavily; using engines as required, to keep her head to sea.

" 9.30 P.M.—Fell calm, and sea dropped.

" 10.30 P.M.—Put her head N.N.E. ; breeze sprang up. *Midi*—Blowing with terrific violence from north.

" 31st Jan., 1 A.M.—Blowing a hurricane from the northward, with very confused sea. 4 A.M.—Wind shifting from all points of the compass, continual rain, high confused sea, with furious squalls. Ship rolling and pitching heavily. . . .

" *Noon*.—Strong head winds, fine clear weather, considerable head sea.

" (Head N.N.W.) 4 P.M.—Fine clear weather and smooth sea.

" 7.50 P.M.—Stopped, and let go in 7 fathoms, outside Quillimane bar.

" 8 P.M.—Light airs from south and smooth water."

There can be no doubt that the storm so simply described in the above extracts, was a true cyclone of unusual severity.

This will be sufficiently proved by the steady but rapidly increasing barometric depression, as the centre or vortex of the storm approached the vessel; the almost dead calm which fell upon her whilst within that vortex, and the sudden shift of wind to the directly opposite quarter of the compass immediately the vortex had passed over; together with the steady rise of the barometer after the centre had passed by.

A reference to the diagrams accompanying this paper will show the cyclone's apparent course upon the coast, and the position of the *Courland* both before and after the centre had passed over her. Until reports have been received from vessels at other points in the Mozambique Channel and far away north and east of the position in which the *Courland* was, upon January the 29th, 30th, and 31st, it will be impossible to tell whether this cyclone covered a large area or not. It is well known that cyclonologists themselves differ upon the question of the diameter of the usual rotatory storm—some, like Birt, Peddington, and Reid, holding that the diameter, in well-proved cases, has far exceeded 500 miles; whilst others, like Maury, incline to the belief that the diameter of the actually gyrating winds never exceeds a tenth of that length—that, in fact, a cyclone is a "whirlwind within a storm."

The winds experienced by us would serve to prove either theory. The remarkable steadiness in their direction for five previous days—almost due south—would be said, no doubt, by the first theorists to be due to the fact that the vessel's course lay upon what is called the "axis of the storm," *i.e.* the direction in which the whole body of the cyclone was moving. Upon this supposition, the edge of the cyclone may be said to have been entered in lat. 26° S. when the strong southerly winds were first experienced, and its *semi-diameter* would then certainly have been over 500 miles.

If, on the other hand, we assume the circle of rotatory winds to have been entered only on the evening of the 29th, when the abnormal depression of the barometer first began to show itself, then the cyclone's diameter would not have greatly exceeded the limit laid down by Maury, for, by

the evening of the 31st, the barometer was normal, and every vestige of bad weather had disappeared.

I, myself, am inclined to believe the diameter of the actually rotating winds was small. It had, I think, rather the appearance of a whirlwind travelling upon the northern edge of a storm. Certainly, the vortex cannot, in a geometrical sense, be called the centre of a cyclone, of which the strong winds met with in 26° S. lat., and upwards, formed a part; for the area of atmospheric disturbance was incomparably larger to the southward of that "centre," or vortex, than to the northward.

I should not omit to say that inquiries made at Quillimane showed that on the 29th and 30th January violent winds were experienced from the south-west, which shifted up to the west and north-west before declining: from which it may be safely inferred that that place was within the range of the circular winds. Also, that the Eastern Telegraph Co.'s ship *Great Northern*, in her passage from Delagoa Bay direct to Mozambique, whose approximate position was to the south-east and east of us upon those days, met with "a hard blow from the south-east," "with a heavy easterly sea,"—evidence which also places her within the cyclonic area.

One word as to the meteorological symptoms that preceded and accompanied this storm, although they were, I may at once say, singularly negative and few. There were none of the appearances that usually betoken a West African tornado or a typhoon in the China seas—no heavy, solid banking-up of clouds, and very little thunder and lightning. The only noticeable feature in an almost uniformly overcast brown sky—over which the "drift" scudded furiously—was a peculiar leaden blue in the zenith during the day, and a clearing of the sky overhead, so that many stars became visible as the vortex passed over the vessel. An extraordinary clearness of the atmosphere succeeded the storm. Although "weather signs" were absent, the barometer proved throughout a true and faithful guide.

The following were the readings of the barometer and thermometer:—

	BAR.	THERM.
JANUARY 29th, Noon, ...	29'61	83
" " 4 P.M., ...	29'57	82
" " 8 P.M., ...	29'53	78
" " Midnight, ...	29'47	77
JANUARY 30th, 4 A.M., ...	29'37	81
" " 8 A.M., ...	29'35	79
" " Noon, ...	29'30	84
" " 4 P.M., ...	29'12	78
" " 8 P.M., ...	28'98	78
(This was the lowest reading in vortex of cyclone.)		
" " Midnight, ...	29'08	81
JANUARY 31st, 4 A.M., ...	29'32	78
" " 8 A.M., ...	29'45	75
" " Noon, ...	29'49	82
" " 4 P.M., ...	29'48	84
" " 8 P.M., ...	29'52	83

No further incident worthy of remark occurred during the voyage to Mozambique, which was performed on the 2d and 3d of February in almost a calm.

I see it is stated in an official publication, *The East African Pilot*, that no reports have been received of cyclones occurring in the Mozambique Channel. The above remarks may therefore be of some value as proving—contrary to the opinion there expressed—that this channel is not free from these destructive storms.

HENRY E. O'NEILL,
Hon. Cor. Mem., Scot. Geog. Soc.

H. M. CONSULATE, MOZAMBIQUE,
Feb. 5th, 1887.

THE PLACE-NAMES OF IONA.

III.

BY ALEXANDER CARMICHAEL.

PORT AONA'AIN.—Port Aona'ain is evidently a modification of the not very pronounceable name of Port Adhamhnain, port of Adamnan. The place is also called Port a Chrosain, port of the little cross.

My intelligent informant—kindly old John Macinnes, now dead—said that his father remembered a beautiful sculptured cross standing immediately above the beach there. It is more than probable that the cross was commemorative of Adamnan, ninth presbyter-abbot of Iona. Hence the two names of the place—Port Aona'ain (Port Adhamhnain), the Port of Adamnan, and Port a Chrosain, the Port of the Little Cross.

There is a Port Aona'ain in Mull, and a Port Aona'ain in Lismore; and there are at least eight ancient dedications to Adamnan in various parts of Scotland, ten in Ireland, and probably some in England and Wales.

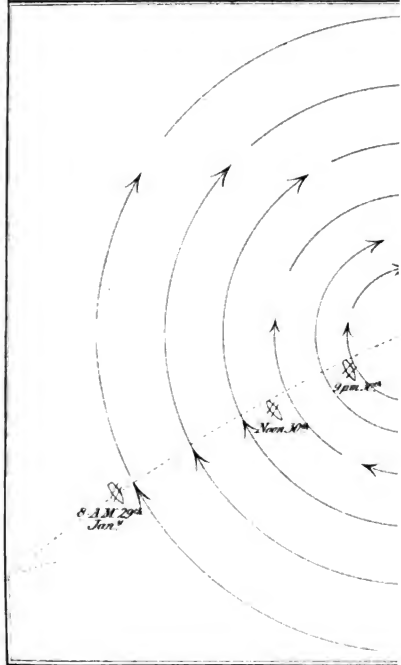
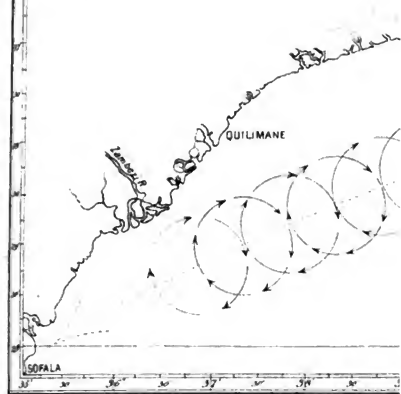
At Clachan-Ard, North Uist, there is a glacial block of some interest to the student of place-names, and to the student of saint-life. The block is of Laurentian gneiss, this being the formation of the whole Outer Hebrides, except a small area of Cambrian Red Sandstone in the neighbourhood of Stornoway.

The stone is situated on the lower spur of a low glacier-rounded hill, facing the Atlantic, and stands on edge on a bare exposed rock. It is of an oblong form, and measures $12\frac{1}{2}$ feet in length, $8\frac{1}{2}$ feet in breadth, and from 2 to 3 feet in thickness. A Latin cross, $13\frac{1}{2}$ inches in length, and $11\frac{1}{2}$ inches in width, is incised on the face of the stone looking towards

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CHART

showing
passage of Cyclone through the
MOZAMBIQUE CHANNEL.



the south. It will be observed that the width is out of proportion to the height of the cross, thus resembling the proportions of a Greek rather than those of a Roman cross. In the Greek cross the length and breadth are equal,—in this respect resembling the cross of St. Andrew. In the latter, however, only two and two of the angles are equal, while in the former all the four angles are the same, and the length of the parts the same, the lines intersecting in the centre. In the Roman cross each of the two arms and the part above the arms are equal, and in the proportion of one-third of the whole shaft.

Feeling assured that the glacial block with the Roman cross had a tradition to tell if it could only be traced, the writer sought out cottars in distant parts who had been crofters in the place. These intelligent men, who “had seen better days,” gave him the following account:—The ice-block was spoken of by the old crofters of the district under various names, as, Clach mhor Guala Chlachain, the big stone of the Clachan shoulder; Clach na h-Ulaidh, the stone of the treasure—from a tradition that treasure-trove is buried near it; Crois Ard, the upper cross, in contradistinction to crosses lower down at the sand-buried ruins of Saint Columba's church and burying-ground; Crois an t-Sagairt, the cross of the priest; and, most interesting of all, Crois Aona'ain or Crois An'adhan, in either case an evident corruption of Crois Adhamhnain, the cross of Adamnan.

The old cottars said that a tradition descended amongst their crofter forefathers of Clachan that the cross had been cut in the stone either by or in commemoration of the first priest who preached the Gospel in the place, and that the people of the period raised the stone on edge and placed it in position where the preacher stood, as a visible memorial of the event. Ever since then that stone has been to me more than a stone upon a lonely hill, and that cross more than a cross traced on a rock by idle hands.

Saint Adamnan became abbot of Iona in 679. He presided over the abbey for twenty-five years, dying in 704, at the age of seventy-seven. Before coming to Iona, Adamnan had been *anam-chara*, soul-friend—that is, spiritual guide—to Fiannach Fleadhach, Fianach of the Feasts, King of Ireland. Bede says that he was a good and wise man, very learned in the sacred writings and in the Latin tongue. Adamnan wrote several works in Latin. That, however, by which he is chiefly known is his life of his great predecessor, Saint Columba. But, valuable as the *Life* is, it is full of difficulties—to the modern student of history on account of its miracles, and to the student of place-names on account of the place-names being Latinised, often rendering it difficult, sometimes impossible, to determine a locality.

Adhamhnain (Adamnan) was a frequent family name among the old Macneills of Barra, a branch of whom was called Clann Adhamhnain, children of Adamnan, and another branch Clann Ghilladhamhnain, children of the servant of Adamnan. During the middle ages the name

of Gilladhamhnain became modified in the English of the period into Gilleownan, Gilleonan, Gillewin, Gilleganan, Gillewan, and latterly into Gillon and Gallion. Probably the names Macinnon, Mackinnon, and Macinnmhuinn are pardonable modifications of the hard name of Mac-ahamhnain, Macadamnan.

A large proportion of Highland names are of ecclesiastical origin. Some examples of these may be mentioned. Gilles, Gillies, is from Gilliosa, the servant of Jesus; Macgillies, from Macgilliosa, son of the servant of Jesus; Gilchrist is from Gillecriosd, the servant of Christ; Macgilchrist is from Macgillechriosd, son of the servant of Christ; Gilmichael is from Gillemicheil, the servant of (S.) Michael; Carmichael is Macgillemhicheil, son of the servant of (S.) Michael; Gilmer, Gilmor, Gilmore, and Gilmour are all from Gillemoire, the servant of Mary; and Morrison, Muireson, from Macgillmhoire, son of the servant of Mary; Gillain is from Gill-sheathain, Seathain being the old form of Iain, John, the servant of (S.) John; Maclean, Macgillsheathain is son of the servant of (S.) John; Gilanders is from Gillandrais, the servant of (S.) Andrew; Macgilandrew is from Macgillandrais, son of the servant of (S.) Andrew; Kilpatrick is from Gillepadruig, the servant of (S.) Patrick; Macgilpatrick is son of the servant of (S.) Patrick; Gilecolum, the servant of (S.) Colum; Macgilcolum, from Macgillecholum, son of the servant of (S.) Colum. The list is a long one, and must suffice.

Another class of these ecclesiastical names ends in diminutives. This arises from the terms of endearment applied to the saints from whom the names were adopted. These end in the masculine *an* and the feminine *ag*, the two Gaelic diminutives. Macmorran, Macmorren, is from Macmoirean (Moirean being the diminutive of Mary), the son of the Maryite. There is a small low-lying isle in the Atlantic behind Staonabrig, South Uist, called by the people of the place Eilean Mhoirean, the isle of Moirean, the isle of the Saint Maryite. Macmicken is from Macmichean, the son of Micehan, the diminutive of Saint Michael; Macfayden, Macfadzen, and all the other forms of this name, are from Macphaidean, son of Paidean, the diminutive of Padruig, (S.) Patrick. Mackeegan is from Maciogán, the son of Iogan, the diminutive of Iain, (S.) John. Macmorrag is from Macmoireig, the son of Little Mary. A green round knoll between Clach-an-a-ghluip and Carnach, North Uist, is called Crois Moireig, the cross of the Little (S.) Mary. There is no trace of a cross here now, nor any tradition concerning it.

Even the sacred name of Jesus was made a diminutive by this mode of endearing. An example of this may be given from the *Calendar* of Oengus Celedé, Angus the Culdee, an Irish saint of the tenth century. The *Calendar*, called in Gaelic *Felire*, contains the names and festivals of vast numbers of Irish, British, and Continental saints, and is altogether a remarkable production. The whole is translated and edited, with copious quotations and learned notes, by the great Celtic scholar, Dr. Whitley Stokes.

This *Calendar* contains a curious hymn, with a still more curious introduction, beginning :—

Isucan
Alar lium imdisirtan
Ciabeth clerech colin *set*
Is bec uile *acht* isucan.

Close translation :—

Jesukin (*diminutive of Jesus*)
Is nurst by me in my little hermitage.
Though it be a cleric with a number of treasures,
All is a lie save Jesukin.

The ecclesiastical names originated in the practice of the early Christian missionaries placing themselves, on joining the brotherhood, under the special care of some sacred name or favourite saint. When a man thus placed himself under the special care of a holy name or favourite saint, he became the devotee of the person whose name he adopted. In token of this he shaved (tonsured) his head. Hence the names Maoldonuich, Maoliosa, Maolmicheil, Maolmoire, Maolpadruig, Maolcalum, Maolciarain, and many others, the meanings of which are, respectively, the tonsured of the Lord (Ludovick), the tonsured of Jesus, the tonsured of (S.) Michael, the tonsured of (S.) Mary, the tonsured of (S.) Patrick, the tonsured of (S.) Colum (Malcolm), and the tonsured of (S.) Ciaran.

Maoldonuich was a term applied to a male child, and *griadach* to a female child, previous to baptism. If the child died before the common name was exchanged for the special name—that is, if the child died before baptism—it was buried in a burial-place specially set apart for the burial of unbaptized children. The prefix *Maol*, rendered Miles or Myles in English, is now discontinued in Gaelic names, though still retained to some extent in English: thus, as Gaelic, *Calum*, old form, *Maolcalum*, English, *Malcolm*.

Protestant Church historians say that the frequency of ecclesiastical names—baptismal names as well as surnames—throughout Scotland, arose from the marriage of the priesthood. This would account for such purely official names as Mactaggart—Gaelic Mac-an-tsagairt, son of the priest; Macnab—Mac-an-aba, son of the abbot; Macvicar—Mac-a-phiocair, son of the vicar; Macpherson—Macaphéarsain, son of the *persona*, son of the parson; Buchannan—Macachanoir, Macachanonaich, son of the canon, son of the canonite; Macvannan—Macamhanoin, Macamhanaich, son of the monk, son of the monkite; Mackellar—Maccealloir, son of the cell-man, son of the superior of the cells, that is, superior of the monastery; Mackellaig—Maceallaich, son of the cell-dweller, now Kelly.

The celibacy of the clergy was formally enjoined by a Bull of Pope Gregory the Seventh (Gregory the Great, Hildebrand) in the eleventh century. It is admitted, however, that this inhibition against marriage was not strictly adhered to even among the regular clergy, and still less among the lay clergy, down to the time of the Reformation. There is another

explanation for the frequency of these ecclesiastical names in Gaelic. A custom prevailed of old throughout the Highlands and Islands—not even yet wholly discontinued in some of the remote isles—of naming a child born on the festival of a saint after the name of the saint upon whose day the child was born.

Saint Columba was patron saint of the whole of Scotland during several centuries. He is still the patron Saint of the Highlands, as far as Highlanders can be said to unbend themselves to the past. Among the old Highlanders, so full of the charming courtier-like manners and the traditional old lore of the past, Saint Columba's Day was a day of much joy and rejoicing. It was a day deemed by them propitious not only to human beings, but to their sheep and cattle and horses, and even to their domestic arts and social exercises. In accordance with the belief of the times, a male child born on this day was a propitious child, and accordingly was baptized Maolcalum (Malcolm). For some years past, however, the prefix *Maol*, tonsured, is omitted, and the child is baptized simply Calum, Colum. The writer knows of only one man, a native of Mull, now called Maolcalum, Malcolm.

In like manner, a male child born on Saint Patrick's Day was named Maolpadruig (Malpatrick). It will be understood from these remarks why this name is so frequent in Ireland. It need hardly be mentioned that all men bearing these and similar ecclesiastical names were not ecclesiastics.

A tombstone in Saint Oran's, Iona, bears the following inscription—"OR DOMAIL FATRIC." Speaking of this inscription in his *Antiquities of Iona*, Mr. Graham says:—"No one of the inscriptions in Iona has been so much written about as this, and antiquaries do not agree as to its signification. It is in the old Gaelic character, and has been usually interpreted into *Donull Fad Chasach*, 'The Cross of Donald Longshanks.'"

The accomplished artist-author then quotes several interpretations, by learned men, of this inscription. Of one of these he says—"Another, supposing it to be Latin, renders it *M'Donnail futo hic*, 'Fate alone could have laid Macdonald here!' These interpretations are interesting and instructive, and either or both might have been applicable to the person buried beneath the stone; but neither the one nor the other is applicable to the inscription on the stone. The inscription is in Gaelic, "OR DOMAIL FATRIC," that is, *Or Do Maolphatric*, "A prayer for Maolphadric," that is, "A prayer for the soul of Maolpadric."

The following inscription is on another tombstone in the same place—"ORAR ANMIN EOGAIN." It would appear that learned antiquarians are equally at variance with regard to the meaning of this inscription. Yet the inscription is as equally simple and intelligible as the previous one, and is neither in Latin nor in Greek, nor in Hebrew, as different contentions claim it to be. The inscription is in Gaelic, and is now nearly effaced, as many of these old inscriptions are:—"ORAR ANMIN EOGAN," *Or Air Anam Eogain*, "A prayer for the soul of Eogan"—Eogan being the endearing diminutive of Eoghan, Eobhan, Eon, Ewen.

These inscriptions are simple, direct, and intelligible. There is nothing obscure, nothing hidden, nothing puzzling about them. The only puzzling thing is how learned men could miss their meaning. The wrong—the worse than wrong—the misleading interpretations tortured out of these simple inscriptions show the treatment to which Celtic men and Celtic matters have been subjected; an arrogance against which the writer would take the liberty to protest with all the emphasis of his nature.

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

AN Ordinary Meeting of the Society was held in the Masonic Hall, Edinburgh, on the evening of 18th April—Mr. John Murray, Director of the *Challenger* Commission, Member of Council, presiding. A paper on "Japan" was read by Mr. Russell Robertson, H.B.M. Consul at Yokohama, who was awarded a vote of thanks, at its conclusion, on the motion of Mr. James Currie. The following elections to the Society, since the last Ordinary Meeting, 24th March, were intimated by the Secretary, viz. :—The Right Hon. H. C. E. Childers, M.P.; R. C. Munro-Ferguson, Esq. of Novar, M.P.; W. B. Barbour, Esq., M.P.; J. G. Baird, Esq., M.P.; John Robertson, Esq., Elmslea, Dundee; Robert Smith, Esq., Bengerth House, Broughty-Ferry; John Gunn, Esq., F.R.P.S., Assistant Naturalist, *Challenger* Commission; Wm. Jolly, Esq., F.R.S.E., F.G.S., H.M. Inspector of Schools, Glasgow; John J. Rogerson, Esq., LL.B., Merchiston Castle; John T. Wills, Esq., B.A., F.R.G.S., London; William Henderson, Esq., Shipowner, Glasgow; Andrew Hewat, Esq., Granton; Dr. Bruce Bremner, Streatham House; Miss MacDougall, Woodburn.

On the following evening, 19th April, Mr. Russell Robertson read his paper at a Meeting of the Glasgow Branch of the Society, in the Hall of the Philosophical Society,—Mr. Renny Watson, Convener of the Glasgow Committee, in the Chair.

A Meeting of the Aberdeen Branch of the Society was held in the Music Hall Buildings on the evening of 21st April, when Mr. Russell Robertson read his paper on "Japan." Mr. David Stewart, Convener of the Aberdeen Committee, presided.

GEOGRAPHICAL NOTES.

EUROPE.

French Census of 1886.—The general results of the census of France, taken on 30th May 1886, are now known. The total population of the country is 38,218,903, being an increase of only 546,855 since 1881. Between 31st December 1876 and 31st December 1881 the increase was 766,260; but it will be observed that the latest census does not cover a period of five complete years. Paris has increased by only 75,527 inhabitants during the period 1881-86, whereas between 1876 and 1881 its population was augmented by 280,217 persons. The eleven towns which follow had each more than 100,000 inhabitants,

on 30th May 1886 :—Paris, 2,344,550 (2,260,023 in 1881); Lyons, 401,930 (376,613 in 1881); Marseilles, 375,143 (360,099 in 1881); Bordeaux, 240,582 (221,305 in 1881); Lille, 188,272 (178,144 in 1881); Toulouse, 147,617 (140,829 in 1881); Nantes, 128,482 (124,319 in 1881); Saint-Etienne, 117,875 (123,813 in 1881); Le Havre, 112,074 (105,867 in 1881); Rouen, 107,163 (105,906 in 1881); Roubaix, 100,297 (91,557 in 1881). Rheims only just falls short of this limit, having a population of 97,903.—*Bulletin de la Société de Géographie de Marseille*, 2^{me} Trimestre, 1887.

Volcanoes in Iceland.—Professor Th. Thoroddsen, teacher in the “*real*” school of Miðhruvellir, Iceland, has published a book on the history of the volcanic outbreaks on his native island. The writers of the ancient sagas seem to have entertained considerable reluctance to speak of the volcanic phenomena of their country. As for the geology of the island, it was never seriously studied until the present century; and even now, although several scientific students have devoted time and attention to the subject, it can hardly be said that we have a satisfactory knowledge of it. This is perhaps largely attributable to the great area of the island, and to the difficulties of communication and of the climate. The interior of Iceland consists of a plateau, about 2065 feet high, having a gradual slope towards the north-north-east and the south-east, and deeply indented by numerous valleys and fjords on the north, north-east, and east. The highest parts of the island are covered with glaciers, which occupy an area of 5404 square miles. Lava fields cover 2857 square miles, of which 1313 belong to the Odáthahraun group of volcanoes. Two chains of volcanic mountains—the Reykjanes and the Snaefellsnes—rise on each side of the Gulf of Faxa, and cross the main plateau in an easterly direction. Volcanic outbreaks seem to be confined to two lines, one of which, in the south of the island, runs from south-west to north-east; the other, in the north, proceeds from south to north.

The existing active cones are classified in eight groups :—(1) The group of Snaefellsnes (with the volcano Eldborg); (2) that of Hekla (Hekla and Randhukambar); (3) Reykjanes (Thurrárhraun, Trölladyngja, and Eldeyjar); (4) Katla (Katla and Eyjafjallajökull); (5) Varmárdalur; (6) the group situated to the south of Vatnajökull (Oraefajökull, Skeidharárjökull, Grimsvatn, Sidhujökull); (7) Odáthahraun (Kverkfjall, Dyngjafjall, Sveinagjá); (8) Myvatn (Krafla, Leirhnukur, Hrossadalr, Björnarfag, Dalfjall).

(1) About the year 950, Mt. Eldborg (64° 47' N. lat. and 22° 19' W. long.) threw out from a crater, 656 feet in diameter and 174 feet deep, a stream of lava about seven miles long by two and one-third miles wide. (2) Of Hekla, there have been eighteen eruptions within historic times. This mountain (63° 59' N. lat. and 19° 43' W. long.) rises by three or four terraces to an altitude of 5105 feet, and is surrounded by vast fields of lava, covering an area of 262½ square miles. Of Randhukambar, the only eruption known occurred in 1343. (3) The peninsula of Reykjanes consists of several plateaux, composed of stratified gravels and trap, rising to a height of 410 feet, and covered with lava. Above these rise a series of volcanoes and cones of scoriæ, attaining an altitude of 2067 feet, and having many hot springs and solfataras. Mt. Thurrárhraun (64° N. lat. and 21° 19' W. long.) was in eruption about the year 1000; and of Trölladyngja (63° 56' N. lat. and 21° 38' W. long.) six outbreaks are recorded. (4) The truncated cone of Eyjafjallajökull (63° 37' N. lat. and 19° 40' 32" W. long.), 5597 feet high, and Katla (63° 37' N. lat. and 18° 59' W. long.) are situated in the midst of deserts of sand, gravel, and rocks, which owe their origin to glacial movements and the influence of volcanic phenomena. The craters of both these are generally

filled with ice. Katla has been in activity on twelve or thirteen occasions within historic times. (5) The most violent volcanic outbursts of which Icelandic annals have kept record occurred in 1783, from a number of craters situated on the south-west, north, and east of Mt. Laki ($64^{\circ} 2' \text{ N. lat.}$) and in the valley of Varmárdalur. The stream of lava ejected from these craters is the largest that ever issued at a single eruption, being $151\frac{1}{2}$ square miles in area and 515 to 615 feet thick. (6) In the unknown desert to the south of Vatnajökull, are situated several volcanoes, none of which have been examined, except Oraefajökull ($64^{\circ} 0' 48'' \text{ N. lat. and } 16^{\circ} 44' 30'' \text{ W. long.}$),—the loftiest peak in the island (6431 feet). (7) On the north of Vatnajökull is the immense lava expanse of Odáthahraun, covering a superficies of 1312 square miles, and containing many craters and volcanoes, the greater part of which are still unexplored. Kverkfjall ($16^{\circ} 54' \text{ W. long.}$) was in eruption in 1717 and 1873. North-west of Kverkfjall the Dyngjafjall group rises to the height of 4593 feet. These mountains enclose the valley of Askja (3610 to 3937 feet above sea-level, and 35 square miles in area), in the south-east angle of which a deep depression has been formed (755 feet deep), having in its centre a lake 3940 feet in diameter, with water that had a temperature of $71^{\circ} 6 \text{ Fahr.}$ in 1876. The craters around this depression were in eruption in 1875. In the same year the crevice called Sveinagjá, north of the Dyngjafjall group, sent out a lava-stream 14 miles long and 6230 feet (!) thick. (8) The environs of Lake Myvatn are almost entirely sheeted with lava, so that they resemble a lunar landscape. The eruptions of 1724-30 took place in the neighbourhood of Leirhnúkr, a volcano of this group.—Jules Leclercq, in *Bull. Soc. Roy. Belge de Géogr.*, Jan.-Feb. 1887.

ASIA.

Herr Glaser's Travels in South Arabia.—In vol. ii. (pp. 232-233), we gave an abstract of this traveller's journey from Hodeida to San'á, in Yemen. That account we herewith supplement from the *Mittheil. d. k. k. Geogr. Gesellschaft in Wien* (Bd. xxx. No. 1, 1887). Herr Glaser went to South Arabia principally for the purpose of pursuing historical and antiquarian studies, and of collecting materials for such studies. But he also devoted a very large share both of his time and of his attention to geography; indeed, he takes a deep and special interest in the ancient geography of that part of the world, and promises shortly a work on the subject.

His *first* visit extended from October 1882 to March 1884, and is divisible into two periods—(1) the journey from Hodeida to San'á, and enforced stay in the latter place till September 1883; (2) the period of his real travels. During the ten months that Herr Glaser was detained by the authorities at San'á, he took advantage of his position to institute and carry out several meteorological observations, and to make important dialect studies from Kabyles and Bedouins of various localities. On the occasion of this first visit he made three separate journeys in all, starting in each case from San'á:—(i.) He explored the Jebel Dhín, 'Amrán, the mountain-chain 'Ajál Jezíd and the ruins of Da'an, Beyt Shahr, Shahrán, and skirted the territory of Habúr. (ii.) This trip extended to Arhab and Háshid, and included the examination of several Sabæan ruins, especially Sirwáh and Ná'it. (iii.) On this occasion the districts to the north-west and west of San'á were visited.

The *second* visit of Herr Glaser to South Arabia was strictly a continuation of his first. He again made San'á the centre for a radial series of excursions to the east and north-east. He also explored part of Khaulán, a great part of the Mad-hadj district, and carefully examined all the ruins of Tafár south of Jerím

to Aden. These expeditions occupied from May 1885 to February 1886. The indefatigable traveller brought with him to Aden 400 Sabæan and Minæan inscriptions; a glossary of several thousand præ-Islamitic words, found in the dialects of existing tribes of mountaineers; a great mass of cartological materials; valuable collections of meteorological, climatic, and commercial matter, as well as of antiquities, and 241 mss.

Ere long we hope to give an abstract of Herr Glaser's general account of the country and its inhabitants, which contains much useful information, especially to those who take an interest in Oriental geography.

Central Asia.—Mr. A. D. Carey, of the Bombay Civil Service, is now making a journey of considerable interest. *Nature* says: "Mr. Carey left India in May 1885, and marched through Ladak into northern Tibet (Chángtán) as far as the Mangtsa Lake, and then struck northward, descending on the plain of Turkestan, near Kiria. He thus traversed over 300 miles of country which had never before been visited by a European. The altitudes on this section of the journey were always very great, the track running usually at about 16,000 feet above the sea, while one, at least, of the passes crossed was calculated to reach 19,000 feet. After a stay at Kiria and Khotan, the Khotan River was followed to its junction with the Tarim; the route then lay along the latter river to Sarik, and then across a stretch of desert to Shah-Yarand Kuchár. From the latter place the Tarim was followed down to a point where it turns south towards Lake Lob. From this point the towns of Kurla and Kárástaber were visited, and about the end of the year the Tarim was struck again and tracked down to Lob-Nor. Thus the whole length of the Tarim has been explored. The country along its banks is described as flat and reedy, and the people extremely poor and miserable. Mr. Carey pitched his camp at the village of Cháklik, some distance south of the lake, and close to the foot of the great range of mountains which forms the northern scarp of the Tibetan highlands. On April 30, 1886, Mr. Carey started from this village on a journey southward into Tibet, over a pass in the Altyn-Tagh range, and onward by a track occasionally used by the Kalmucks. Since this start, nothing has been heard of Mr. Carey, but it is presumed that, after spending the summer and autumn in travelling over the elevated region, he has returned to Turkestan to winter."

MM. Bonvalot, Capus, and Pépin, in Central Asia.—These travellers, after leaving Meshed in the end of May 1886, made four attempts to enter Afghanistan, but on every occasion they were at once taken prisoners by the Afghans, and finally sent out of the country. The last attempt was made from Samarkand, by way of Hissar and the Kabadian country; their return journey was taken along the valleys of the Surkhan and the Kafirnihan, and across the Baisún Mountains. During the southward journey they had to cross the passes called Takta Karatcha (circ. 5500 feet above sea-level) and Aucha (15,585 feet), both of which have a difficult descent towards the south, the paths being steep and rocky. Below the latter pass, on the south, flows the river Sangalak, a tributary of the Surkhan. It has a very rapid torrent, and its waters are stained a deep red by the sandstone and clay they traverse. At this point the Sangalak makes its way through a wild narrow gorge, the talus slopes of which are covered with the usual timber trees found on the mountains of Turkestan—viz., the walnut, maple, juniper, *Celtis*, *Mespilus*, apple, elm, etc. The geological structure of the mountains is the same as that of the Kungur Mountains to the north of Kashi and the mountains of Derbend, Kilef, and Shirabad. The valley of Kafirnihan extends from Hissar down to the junction of the river Kafirnihan with the Amu. Its mean width is some $2\frac{1}{2}$ or 3 miles, and it is bounded on both

east and west by chains of hills of moderate elevation (probably of secondary formation), and scored by numerous small torrents, now dry. The soil of the whole valley seems to be largely impregnated with saline matter, and the flora is essentially such as thrives upon saline soil. The hills are almost destitute of vegetation. The alluvial ground along the water-courses is set with thickets of tamarisks, *Eleagneæ*, and roses. Although the travellers were unable to accomplish the object of their expedition, owing to the jealousy of the Afghans, yet they have not omitted to carry out a number of scientific investigations during their journeys to and fro.

They have now determined to return home *via* the Pamir and Hindustan, starting from Lake Gulcha, and proceeding by way of Kara-kul, the Pass of Tuyuk, the river Almagane, and the small khanate of Kundjut or Kundju, whence they will pass into India.—*Comptes Rendus de la Soc. de Géogr.* (Paris), Nos. 1, 2, 4, 6, 1887.

Submarine Configuration of the Eastern Part of the Bay of Bengal.—Mr. F. R. Mallett has just published, in the *Records of the Geological Survey of India*, a series of soundings taken by Commander A. Carpenter of H.M.I.M.S. *Investigator*. They show that the volcanic peaks of Barren Island and Narcondam rise from about 1000 fathoms of water, and that the submarine slope is little different from the sub-aërial, being sometimes greater than it, sometimes less. The mean submarine slopes from the shore for $2\frac{1}{2}$ miles seaward in three directions from Barren Island were, respectively, $16\frac{1}{2}^{\circ}$, $18\frac{1}{2}^{\circ}$, and $20\frac{1}{2}^{\circ}$; in one direction—to SSW. of the island—the slope was much more gentle. The material brought up by the sounding-rod on the slopes consisted chiefly of black volcanic sand; no organic deposit was found except at a considerable distance from the islands, and at a greater distance off the active volcano of Barren Island than off the extinct Narcondam.

At depths of over 1000 fathoms, the bottom temperature inside the chain of islands running from Acheen to Cape Negrais was found to be $41^{\circ}2$, and at a similar depth in the Bay of Bengal $37^{\circ}6$. In the open bay the temperature of $41^{\circ}2$ was found at a depth of 740 fathoms; hence it would appear that the ridge from which the Nicobar and Andaman Islands rise is nowhere more than 740 fathoms beneath the surface. Three principal channels break through the island chain; one of these, Preparis Channel, is 150 fathoms deep; the Ten Degree Channel is marked with no soundings on the chart, and the southern channel is marked as 760 fathoms. If the temperatures quoted above have been correctly ascertained, there can be little doubt that the region under consideration is a new enclosed sea, to which Captain Carpenter might give the name of Andaman Sea. A more detailed survey of this district will be looked for with interest.

The Tinguianes of Luzon.—Professor Blumentritt continues his paper (from the Spanish of Don Isabelo de los Reyes) on the Tinguianes of the Philippines in Nos. 2 and 3 of *Mittheil. d. k. k. Geogr. Gesellsch. in Wien* (1887). He treats his subject under the following headings:—"Origin of the Tinguianes;" "Dwellings, and Clothing;" "Religious Usages;" "Administration and Customs;" "Occupations, Music, and Language;" "Historical Sketch." (See vol. iii. p. 203).

AFRICA.

Capello and Ivens's Journey across South Africa, 1884-85.—The objects of the journey undertaken by the two Portuguese officers, Herm. Capello and Rob. Ivens, in the years 1884 and 1885 were, in the first place, the discovery of a practicable commercial route between the Portuguese possessions situated on the west and on the east coast of Africa, respectively; the settlement of certain

points connected with the hydrographical systems of the Zambesi and the Congo; and, especially, the exploration of the unknown region lying between the two, mainly with the view of ascertaining what advantage could be got from the products of that region. In conjunction with these labours, they were also concerned to carry on the scientific studies and make the scientific observations of all kinds which we always look for nowadays from a well-equipped and competent geographical exploring expedition.

The most interesting part of the journey begins when the explorers reach the basin of origin of the river Cabompo, a tributary of the Zambesi. This basin lies within the region where the Lualaba, the great tributary of the Congo, has its sources. It is thinly populated; and the banks of the Cabompo are heavily timbered, and infested with the destructive tsetse.

After crossing the Kitangula Mountains, which form the watershed between the Cabompo and the Kafue—the latter a stream that flows southwards to join the Middle Zambesi—Capello and Ivens entered the well-settled districts of Msiri's dominions. This potentate has reared up his power on the ruins of that of Casembe, who was dominant in this part of Africa at the time of Livingstone's visit in 1868. Msiri's sway extends over all the territory lying between the rivers Lualaba and Luapula, two main feeders of the Congo, stretching from Lake Kikondja in the north to Munnbeye in the south-west, and the Mushinga Mountains (the watershed between the Zambesi and Lake Bangweolo) on the south. His capital, which is called Bunkeia (the Unkkää of Reichard), is situated in $10^{\circ} 23' 12''$ N. lat., and $27^{\circ} 14' 10''$ E. long. This was the furthest point north reached by the expedition. In consequence of the threatening attitude of the natives, the travellers were compelled to turn south, but not before they had made unsuccessful attempts to reach Lake Bangweolo and the western side of Lake Meru through the Katanga country, which is noted throughout Central Africa for its wealth in copper.

From this point Messrs. Capello and Ivens travelled almost direct south till they reached the Zambesi, west of Zumbo, the position of which they fix in $15^{\circ} 38' 3''$ S. lat., and $30^{\circ} 21' 25''$ E. long. (Livingstone's calculation gave $15^{\circ} 37' 22''$ S. lat., and $30^{\circ} 32'$ E. long.)

The scientific results of the expedition are considerable. Sixty-nine latitude and fifty-nine longitude observations were made; magnetic determinations were taken at twenty-five points; many investigations and observations were carried on bearing upon the meteorology of the regions traversed, as well as upon the atmospheric pressure, the direction and strength of the wind, and the cloud formations. The peoples whose territories they passed through were studied, and valuable collections were made of the flora, fauna, and geology.—Herr H. Wichmann, in *Petermann's Mittheilungen*, Bd. 33, No. 2, 1887.

Lake Assal, in Obok.—The engineer, M. Suais, has been commissioned by the French Colonial Office to explore Lake Assal, situated within the boundaries of the French colony of Obok. This lake, which contains rich deposits of salt, is situated about eleven miles inland from the head of Tajurrah Bay. According to the observations of Lieut. Christopher, who accompanied Captain Harris's expedition to Shoa in 1841, Lake Assal lies 559 feet above the sea-level.

Discovery of a Lake in Shoa.—From a short letter written by Dr. Traversi, and printed in *Bull. della Sezione Fiorent. d. Soc. Afr. d'Ital.* (iii. fasc. 1-3), we learn that this traveller has discovered, to the west of Lakes Zuai and Hogga, a third lake, connected with the two named. The natives call it Lamini; but Dr. Traversi has christened it Boutourline. Further details are promised in the next issue of the above magazine.

Blantyre : East Central Africa.—The following is a summary of the meteorological observations made at Blantyre during 1886, and forwarded to us by the Rev. Alexander Hetherwick :—*Barometer*—Mean height for the year, 26'59 inches. Highest monthly mean, 26'68 (July); lowest, 26'48 (March). Maximum monthly range (March), 0'31; minimum, 0'19 (June); mean, 0'23. Highest reading occurred in July, 26'78; lowest in March, 26'34; therefore, extreme yearly range is 0'44. Mean daily range, 0'06. *Temperature*—Mean temperature for the year, 64'8. The hottest months are October, November, and December, showing a mean temperature respectively of 74'2, 73'9, 73'1, and the coldest months June and July, the temperatures being 60'9 and 58'2. The monthly range presents in September a maximum oscillation of 43'5 (88'4—44'9), and in January a minimum of 22'0; mean monthly range, 29'8. Of mean daily range a maximum of 21'8 obtained in August, and a minimum of 10'4 in March. Highest temperature found in November, 95'3; lowest in July, 44'8; therefore, yearly range is 50'5. *Rainfall*—Total amount for the year, 55'78 inches. Rain fell on 109 days. The maximum daily rainfall was 2'35 inches, and occurred in January. January, February, and March are the most rainy months, and August and September the least. The rainfall for 1882 was 50'84 inches; and for 1883, 52'72 inches. For 1886—January, 17'65; February, 11'89; March, 14'86; April, 1'45; May, 3'84; June, 0'13; July, 0'09; August, 0'01; September, none; October, 0'72; November, 0'88; December, 4'26. *Wind.*—*Velocity*—Daily mean, 146'1 miles. Maximum monthly in July and September, having a daily mean of 218'0 and 218'8 miles respectively; minimum in March, having a daily mean of 86'5. Maximum daily on 1st April, 562 miles; and minimum on 29th January, 41 miles. *Direction*—The winds S., SSE., SE., and ESE., are the most prevalent from March to July (inclusive), the E., ENE., NE., and NNE. during the rest of the year; and these winds include 666 out of 730 observations. The winds N., NNW., NW., and WNW., which are most common from October to March (inclusive), and the W., WSW., SW., and SSW. in January and February, include only 64 of 730 observations. Westerly winds nearly always bring rain, but the greater proportion of the rain comes from an easterly direction. *Humidity*—Mean relative humidity for the year, 68'5. The months January, February, and March are the most humid, having a mean of 81, and September, October, and November the least, having a mean of 51. The maximum monthly mean, 84, obtains in March, and the minimum, 48, in October.

The Transvaal.—The following extract is from a private letter by the Hon. J. X. Merriman, M.L.A., of the Cape Colony, dated 23d February 1887, addressed to Mr. John G. Gamble, an Honorary Corresponding Member of the Society :—“ I am much impressed by the Transvaal, the California of the future. The scenery of the eastern goldfields is charming, quite un-African : green mountains, wooded valleys, running rivers. It is a place where, gold-finding apart, a man could fancy settling down and making a home. As for the gold, it is difficult for an outsider to speak with confidence. When I was there, every head of stamps was crushing at the average return of one ounce of gold for every ton of quartz crushed, which is, I believe, a most enormously high average. The Sheba Company, with a wretched ten-stamp mill, are getting eighty odd ounces of gold a day, but this is an exceptionally rich return. The geology is most interesting—granite, with large beds of tilted slate, and quartzite intersected with quartz veins. In the middle of the Transvaal they have discovered large deposits of gold-bearing conglomerate, which carries good prospects. There has been great excitement about this, as it is in a most healthy district and fairly accessible . . . I think

it not unlikely that the next healthy season will lead to the discovery of good alluvial fields."

The Emin Pasha Relief Expedition.—Mr. H. M. Stanley, in a letter to the *Times* of 31st March, gives some further interesting particulars of his expedition. His party consists of the following:—Major Edmund M. Barttelot, 7th Fusiliers; Lieutenant W. G. Stairs, Royal Engineers; Captain R. H. Nelson, of the Volunteers; Mr. Mounteney Jephson; Mr. J. S. Jamieson, naturalist; Surgeon T. H. Parke and Mr. William Bonny, of the Hospital Staff Corps; 61 Soudanese soldiers, 13 Somalis, a personal attendant, and two interpreters.

In a private letter from Mattadi, dated 21st March, Mr. Stanley stated that a serious famine existed as far up the Congo as Stanley Pool, and referred to the difficulties he had to overcome in the transport of his expedition.

Explorations of the Affluents of the Congo.—Short particulars of two fresh journeys opening up the hydrographical system of the Congo are to hand. (1.) Mr. Grenfell has ascended the Lower Koango as far as the falls of Kikunji, in 5° 8' S. lat. About six miles above its confluence with the Kassai, the Koango is joined on its right by a large tributary, the Juma, coming from the south-east. This stream is so large that Mr. Grenfell is uncertain whether it may not be the main river. A short distance above the confluence of the Juma, the channel of the Koango is deflected towards the south-west, then towards the west; and beyond 4° 30' S. lat. it resumes its southerly direction.

(2.) The river Mongalla, another tributary of the Congo, was ascended in last November by Lieut. Baert. At its mouth it has a width of nearly 550 yards. Its general direction is from east to west, and its course is very sinuous. Its banks are at first marshy, and the marshes are backed at some distance by primeval forest. Two days' journey up stream lies the country of the Basoko, who traffic in salt and potash. Somewhat higher up, in the Bakutu country, the banks begin to rise and the river has fewer windings. Still higher up, in the region inhabited by the Sebis, the banks continue to rise; and there too the Mongalla receives a left-hand tributary coming from the east. By this the main river has decreased in width to not more than 33 yards; but its rate of flow is much accelerated. The bed of the river consists of rock, and in several places its depth does not much exceed 4 feet. The Mongalla seems to be formed, in the district of its source, of four streams. The principal branch comes from the north-east; its waters are black and scanty, and its banks are only about 33 yards apart. A right-hand feeder, coming from the north, has a yellow flood, rapid flowing and churned into froth. Immediately above its confluence it is barred by a fall 16½ feet high. A little more than 4 miles beyond this, the main branch is joined by a left-hand affluent, which comes from the south-east. This again is soon followed by a third, with a westerly flow, which is also crested with much foam, indicating the proximity of waterfalls or rapids. It was a little above the confluence of this river, where the Mongalla had a width of about 20 yards and banks nearly 100 feet high, that Lieut. Baert turned back.—*Le Mouvement Géographique*, 10th April 1887.

Herr Wissmann's Explorations in the Congo Basin.—This indefatigable explorer of the southern portion of the immense Congo basin set out in July last, with *M. de Macar*, to make a geographical reconnaissance of the country of the Baluba and the basin of the Lubilashe (the upper Sankuru), lying to the east of the Luluaburg station. Before reaching the Baluba country, Herr Wissmann and his colleague traversed that of the Bashilange, which stretches between the Lulua and the Lukula, a left-hand tributary of the Lubi. This is a magnificent region, and is densely populated, the Bashilange living in large villages perched, for the

most part, on the hill-tops. The country of the Baluba, which begins from the Lukula, consists of undulating prairies, destitute of trees, and with a soil that is apparently little adapted for cultivation. Nevertheless, this region also is inhabited by a dense population, who are reported to be inhospitable and difficult to deal with. The expedition, owing to the obstinate hostility of the natives, was obliged to beat a retreat after advancing as far as the banks of the Bushimané, a tributary of the Lubilashe.

On the 16th of November following, Herr Wissmann again left Luluaburg, accompanied by Lieut. Le Marinel, with the intention of reaching, in the first instance, the confluence of the Lubi with the Sankuru. From that point an attempt will be made to push northwards into the unknown country in which are the sources of the rivers Lulonga, Chuapa, and Lomami; and lastly, if things go well so far, Herr Wissmann will strike eastwards, in order to reach Nyangwé.—*Le Mouvement Géogr.*, 27th March 1887.

AMERICA.

Indigenous Population of Greenland.—Towards the end of the year 1885 the number of the indigenous inhabitants of Northern Greenland was 4414 (2119 males and 2295 females), and of Southern Greenland 5500 (2557 males and 2943 females)—in all, 9914 (4676 males and 5238 females). The increase in the population in 1885 was—for Southern Greenland 31, and for Northern Greenland 86.—*M. Em. Hansen-Blangsted*, in *Comptes Rendus de la Soc. de Géogr.* (Paris), No. 5, 1887.

Alaska.—The United States Government has voted \$50,000 for a preliminary reconnaissance and examination of the boundary-line between Alaska and British Columbia. The basis of the operations will be the conventional boundary defined in the treaty of 28th February 1825, between Russia and Great Britain, and confirmed in that of 30th March 1867, between Russia and the United States. In those treaties the boundary-line is defined as follows: Commencing from the southernmost point of Prince of Wales Island, in 54° 0' 40" N. lat., the line proceeds north along Portland Channel as far as 56° N. lat. From this point it follows the summits of the mountain ranges that run parallel to the coast as far as the intersection of 56° N. lat. with long. 141° W., and thence it coincides with this last up to the Arctic Ocean. Prince of Wales island belongs wholly to the United States. On the West, the extreme limit of Alaska Territory passes through a point in Behring Straits, in 65° 30' N. lat., at its intersection with the meridian that passes midway between the islands of Krusenstern (or Ignalook) and Ratmanoff (or Noonerlook). From that westernmost point the boundary-line proceeds due north to the Arctic Ocean. In the opposite direction it goes nearly south-west through Behring Strait and Behring Sea, passing midway between the north-west point of St. Lawrence Island and the south-east point of Cape Ghukotski, to long. 172° W.; thence, still in a south-west direction, midway between Attore Island and Copper Island of the Komandorski group, as far as 167° E. long., so as to include all the Aleutian Islands situated to the east of that meridian.—*Kosmos*, March 1887.

A *Times* telegram (Philadelphia, April 19) states that "the Canadian Government have sent a geological expedition to explore the gold-fields in the Yukon country in northern British Columbia, headed by Dr. Dawson," and that "the American Government gives them safe conduct across Alaska."

The River Ikpihpuk, in Alaska.—Ensign Howard, of the U.S. Navy, discovered last year the sources of a hitherto unexplored river between the Yukon and the Arctic Ocean. Starting from Fort Cosmos on 12th April, the traveller

proceeded by means of a sledge for seven days down the frozen river Cadwell. Then, crossing a chain of mountains, he came to the unknown sources of the river Ikpiuk. In June, when the ice on this river broke up, Mr. Howard travelled for 200 miles down it in a boat of dried skin. At its mouth the river spreads out into a great number of lakes and marshes, some of which are five miles across.—*Le Mouvement Géographique*, 10th April.

The Coast Tribes of British Columbia.—Dr. Franz Boas, who visited the tribes of British Columbia in the autumn of 1886, gives the following preliminary report on some results of his journey :—

Vancouver Island and the mainland opposite are inhabited by numerous tribes, which belong to three linguistic stocks—the West Vancouver tribes, of the outside coast of Vancouver Island; the Selish tribes, which occupy the south-east part of the island as far as the narrows separating it from the mainland, and inhabit the banks of the lower part of Fraser River and the neighbouring fiords; and the Kwakiutl tribes, which occupy the northern part of the island, and the mainland as far north as Gardner Channel. The latter tribes surround the territory of the Bilhula of Bentinck Arm and Dean Inlet, a tribe belonging to the Selish stock. Further north we find the Tsimpshian and Tlingit on the mainland, and the Haida on Queen Charlotte Islands.

The Selish language is divided into a great number of dialects, differing widely from one another. Under the name "Coast Selish" we include the dialects of Puget Sound and of the Gulf of Georgia, as those dialects are more closely connected with one another than with the Selish dialects of the interior.

Through the descriptions of Swan, Sproat, Krause, and others, the mode of life of these tribes is tolerably well known. Their large wooden houses, their canoes, their fishing-gear and hunting-methods, have been frequently described; but their traditions, religious ideas, and social organisation are not known equally well. According to all observers, the principal figure in the mythology of the Tlingit is the raven Yetl, who created the sun, moon, and stars, who gave man the fresh water and the fish, and whose exploits are said to be so numerous that a life-time is not sufficient to relate them all. Dawson found the same traditions among the Haida; and, according to the Rev. Mr. Duncan, the Tsimpshian tell the same stories of Tghemshen, the man who was able to transform himself into a raven. It is a characteristic feature of the "raven" legend that the bird did not create all things for the benefit of mankind, but in order to revenge himself. While studying the tribes of Vancouver Island, numerous traces of this legend were found, though only very fragmentary and disconnected. Among these people the raven is not considered the creator of the sun, the water, the trees, etc.; but his adventures, which generally refer to his voracious appetite, and his cheating people and animals in order to satisfy it, are frequently related by the natives.

The most important legends of the Kwakiutl are those referring to Kanikilak. They believe in a Supreme Being living in heaven, whom they call Kantsoomp ("our Father," or, in some instances, "our elder brother"). He sent down to the earth his two sons, Kanikilak and Nomokois, who were born there again of a woman, the wife of the woodpecker. Their mother's blanket contained the salmon, which they liberated by dipping the corner of the blanket into the water. Then Kanikilak travelled over all the world, becoming the friend of all the mighty chiefs whom he met on his way, and transforming all the malignant men into animals. The name, in the Kwakiutl language, of those ancient beings who were neither men nor animals, is Nughnemis. We find the same or a similar tradition belonging to all the tribes from Puget Sound to the district of the

Tsimpshian. Among the Shelish tribes the name of the Son of God is Häls; among those of the west coast the name is Alis. The northern tribes—the Tsimpshian, Haidi, and Tlingit—tell of those human-like beings which were transformed into animals during a great flood.

The supreme being spoken of above seems to have originally been the sun, though the identity of both does not appear very distinctly in the traditions of the natives. However, their ancient identity may have been lost in course of time, as among all the tribes legends of different origins are evidently intermixed. In the same way as the raven story has spread south, losing on the way its important place in the mythology of the tribes, the Kanikilak story seems to have spread north; and the traditions, in their present state, seem to consist of elements of at least two different origins. The Skoamish call the sun “the great waudering chief.” The Nanaimo (Snanaimugh), in speaking of the sun as the supreme being, call it Shimhayith. The Bilhula call their supreme being, besides Taata (“our Father”), by the name Sngh, which is evidently connected with *sōngh* (“sun”). In the Kwakiutl legends the sun is the father of the mink, and this tradition is so closely connected with others relating to the supreme being, that the identity of both becomes highly probably. The tribes of the southern part of Vancouver Island ascribe to the mink all the exploits that are told further north as having been accomplished by the raven, and add a great number of others which belong to the mink alone. The Qomoks of the central part of Vancouver Island relate both traditions separately. Those of the raven refer to its voracious appetite, while those of the mink have a highly erotic character.

The Qomoks, Heiltsuk, and the Bilhula of Bentinck Arm are particularly interesting, as we may observe with them the transference of legends from one tribe to another. The Bilhula have a tradition of their own describing the origin of mountains, woods, and animals, which, though influenced by the legends of the Tlingit and Tsimpshian, has a peculiar character. They say that after the raven had created the sun, four men—Masmasalanigh, Yulatimot, Matlapalitsek, and Matlipekoagh—descended from heaven and created everything, after which they returned. Masmasalanigh and the raven are said to be identical, and all his works originated in Yulatimot's mind. The same tradition is found among the Heiltsuk. Though they speak a dialect of the Kwakiutl, their customs and their belief are closely allied to those of the Bilhula. They say that two men, Masmasalanigh and Noakaua, descended from heaven and created everything. Similarly the Qomoks, who belong to the Selish family, have adopted a great number of traditions and customs of the Kwakiutl.

The most important of these is the cannibalism connected with the winter dances. The custom prevails among the Kwakiutl, Tsimpshian, Bilhula, and Qomoks, and is said by some natives to be practised by the Tlingit. According to the Kwakiutl tradition, one of their ancestors descended from heaven, wearing a ring of red-cedar bark, and taught people the cannibal ceremonies. The Tsimpshian tell of a man who, in pursuit of a bear, came to a mountain that closed upon him. In the interior he learned the dances connected with the cannibal ceremonies, and taught them to his tribe after his return. This custom has evidently been adopted only by the Bilhula, as none of the Selish tribes except the Quomoks practise it. The latter have adopted only part of the ceremonies, and replace the terrible practice of devouring corpses by eating artificial ones, that are made by sewing dried halibut to a human skeleton.

Among the northern tribes originated the use of the well-known copper plates, which are highly prized, and which increase in value the more frequently they change their proprietor, and the longer their history is. They became

known to the Bilhula quite recently, and I am told by old natives that they have never been in use among the Indians at the mouth of Fraser River.

There is a remarkable difference between the social institutions of the Tsimpsian, Tlingit, and Haida, and those of the rest of the tribes. Among the former the children belong to the gens to which the mother belongs : among the latter they follow the father's gens. This fact indicates a close connection between the Kwakiutl and Selish tribes ; and, as a consideration of the languages shows some affinity of the two peoples, it is possible that the Kwakiutl are a remote branch of the Selish stock. The animal crest which prevails in the north is not found among the southern tribes. Their gentes derive their origin from a fabulous being which descended from heaven dressed in a bird's skin or in the shape of a man. Members of one gens are not allowed to intermarry, but have to take their wife or husband from another gens. In some of the tribes there are as many as from fifteen to twenty gentes.

Every tribe owns its district for fishing and hunting purposes and for gathering berries. Inside the boundaries of the tribe, each family has its own claim to certain rivers and parts of the coast, which they derive from their ancestor ; but we are far from knowing the actual distribution of tribes and gentes. Even their number and names are still doubtful in many of the districts.

The common culture which extends over tribes of a great number of linguistic stocks of the north-west coast is one of the most attractive problems of American ethnology, and one deserving a thorough study. However, the ethnological character of these Indians is disappearing rapidly through their permanent contact with the whites ; and within a few years it will be too late to collect the vast material that may readily be gathered at the present time. Puget Sound, the Selish of the interior, the Tsimpsian, are actually unknown, and an explorer may glean ample results by visiting some of these tribes, and contribute new and valuable material to American ethnology.—*Science*, March 25, 1887.

The North American Lakes.—Mr. L. Y. Schermerhorn embodies in a paper published in the *American Journal of Science* for April, the facts known concerning the physical characteristics of the northern and north-western American lakes. The drainage basin of these lakes has an area of 270,000 square miles, distributed as follows :—

Name.	Water Surface (square miles).	Drainage Area (square miles).	Total area of Basin (sq. miles).
Lake Superior, ...	31,200	51,600	82,800
St. Mary's River, ...	150	800	950
Lake Michigan, ...	22,450	37,700	60,150
Lake Huron and Georgian Bay, ...	23,800	31,700	55,500
St. Clair River, ...	25	3,800	3,825
Lake St. Clair, ...	410	3,400	3,810
Detroit River, ...	25	1,200	1,225
Lake Erie, ...	9,960	22,700	32,660
Niagara River, ...	15	300	315
Lake Ontario, ...	7,240	21,600	28,840
Total, ...	95,275	174,800	270,075

The line of greatest depth is in all cases along the main axis of the lake, and although it does not bisect the water area, it divides the lake basin into two

almost equal parts. The deepest point also, although situated considerably to the north or east of the centre of the lake, is always (with the exception of Lake Erie) at or very near the centre of figure of the drainage basin. The lakes and their connected rivers include 5400 miles of coast. The recent United States Lake Surveys have fixed the height of the mean surface of each lake above mean sea-level, and these figures, with the depths of each lake, we tabulate as follows, giving soundings in fathoms as well as in feet, and adding the depression of the lowest point below mean sea-level :—

Name.	Height of Surface above Sea-level.	Mean Depth (approximate).		Maximum Depth.		Depression of Max. Depth below Sea-level.	
	Feet.	Feet.	Fathoms.	Feet.	Fathoms.	Feet.	Fathoms.
Lake Superior,	601·8	475	79	1008	168	406	67½
Lake Huron, .	581·3	250	41½	702	117	121	20
Lake Michigan,	581·3	325	54	870	145	289	48
Lake Erie, .	572·9	70	11½	210	35	—363	—60½
Lake Ontario,	246·6	300	50	738	123	491	82

It thus appears that in depth the great lakes of America do not exceed the fresh-water lakes of the west of Scotland, the deepest sounding in Lake Superior being the same as that in Loch Morar. The rivers connecting these lakes seldom exceed 50 feet in depth. The difference of level (326 feet) between Lakes Erie and Ontario is thus distributed :—100 feet in the five miles of rapids between Leviston and the Suspension Bridge, 10 feet in the rapids between the Bridge and the Falls, 160 feet at the Falls, 50 feet in the rapids immediately above the Falls, and 6 feet in the Upper Niagara River.

Analysis of the deepest water of Lake Superior failed to show any traces of salt. The lake bottoms are covered with soft clay varying in colour from red or yellow to blue, the blue predominating in great depths. The temperature of Lake Superior at depths exceeding 200 feet (33½ fathoms) varies but slightly from 39° F. In Lake Huron, in June and August, when the air temperature was 64° F., the surface water was 52°, that at 300 feet (50 fathoms) also 52°, and at 624 feet (104 fathoms) 42°. The somewhat remarkable statement that the same temperature occurs at surface and 50 fathoms in summer suggests that there is some mistake either in the observation or the record.

The volume of water in the lakes is about 6000 cubic miles, and Lake Superior contains nearly one half of this. The supply stored up would be sufficient to maintain Niagara Falls for 100 years. The following table gives the average rainfall in inches per annum and discharge in cubic feet per second :—

Name.	Rainfall.	Place of Discharge.	Discharge.
Lake Superior, ...	29 inches.	St. Mary's River.	86,000
Lakes Michigan and Huron,	31 inches.	St. Clair River.	225,000
Lake Erie, ...	34 inches.	Niagara.	265,000
Lake Ontario, ...	34 inches.	St. Lawrence River.	300,000

The discharge is slightly less than half the rainfall, while in the cases of the Ohio and Mississippi it is only one-fourth of the rainfall.

The lake level changes chiefly on account of wind and rain. The greatest observed difference from the former cause—between a north-east gale on 18th August 1848 and a south-west gale on 18th October 1849—was $15\frac{1}{2}$ feet at Buffalo. Waves from 15 to 18 feet in height have been observed in winter. The lowest water of the year occurs in March on Lake Superior, and in November and March on the other lakes; the highest level in September on Lake Superior, in June and July on the others. The average annual differences derived from 20 years' observations are:—Lake Superior, 1'2 feet; Michigan and Huron, 1'3; Erie, 1'6; and Ontario, 1'9. Some irregularity in rise and fall during the last ten years is attributed to the change in rainfall produced by extensive clearing of forests. The United States Survey have detected small tides in the lakes, the rise at Chicago being $1\frac{1}{2}$ inches for neaps and 3 inches for springs. Regular land and lake breezes occur, the breeze from water to land commencing in summer at 8 or 10 o'clock A.M., and continuing until sunset; that from land to water commences about 9 or 10 P.M., and lasts until sunrise. The lakes exert a notable influence on the climate of their shores; compared with places in the same latitude, 50 and 100 miles inland, the lake-side is about 2° F. warmer in autumn and winter, 5° colder in spring and summer, and its annual range of temperature is 5° less.

Mr. Schermerhorn's paper is illustrated by an interesting map of the lakes, and several diagrams.

From an article entitled "Die Republiken von Spanisch Amerika," contributed by Dr. H. Polakowsky to the *Revue Coloniale Internationale*, for April, we make the three following abstracts:—

Nicaragua Canal.—According to the 'Report of the U.S. Nicaragua Surveying Party, 1885,' by A. G. Menocal, the proposed canal is to commence at Puerto, and follow, first, the valley of the Rio Grande, and then that of the Rio Lajas as far as Lake Nicaragua. The upper end of the former river will be connected with the latter by a special canal. The Nicaragua Canal will cross the lake from the former mouth of the Rio Lajas to the outflow of the San Juan, which river it will then follow to the valley, whose lower portion is watered by the little Rio San Francisco. The waters of the San Juan will be held up by a great dam at Ochoa, east of the mouth of the Rio San Carlos. The San Francisco again will be separated from the San Juan by another dam; thus, a large artificial lake will be formed having the same niveau as Lake Nicaragua. A short canal would have to be dug to connect San Juan with the San Francisco basin. Hence the canal traverses the enclosing mountains in long curves, and on emerging from them proceeds in a straight line to Greytown. Along this part of its course three sluices will have to be constructed, and four in the valley of the Rio Grande. The total length of the Canal will be 169'8 miles, of which 40'3 will have to be excavated. The total cost is estimated at \$64,036,197, or £12,807,240. [According to a paper by Commander H. C. Taylor, U. S. Navy, in the *Bull. Amer. Geogr. Soc.* (No. 2, 1886), the floor of the canal is to be 80 to 120 feet wide, and its surface 80 to 300 feet wide; its depth will be 28 feet.]

Geological Development of Northern South America.—Professor H. Karsten has recently published another important work on the above region, in which he sketches the following stages of geological development through which it has passed. The volcanic mountains of Guiana were the first to lift themselves above the Cretaceous Sea, and then appeared the similarly constituted ranges of Cumana (Trinidad, Paria), Caracas, Santa Marta, Merida, Ocaña, which surround

the system of Guiana in wide and distant curves, and which can be traced further to the south as islands extending into the Cretaceous Sea. On the west side of these ranges there appeared in the later Cretaceous age a porphyry formation, which occurred at isolated points (Baul, Paraguana) in the north, and whose height increased steadily towards the south. In Tertiary times almost the entire bulk of the continent rose above the water, whilst at the same time the Andesite formation burst forth from the huge fissure running from north to south, and likewise attained its greatest elevation in the south; contemporaneously with these changes, the older formations were also somewhat elevated, though to a very small extent, on the north coast (Santa Marta, Caracas, Paria). The Tertiary deposits cover not only the valleys and wide savannahs of the Orinoco, but also in the south-west the Trachytic chain, mounting in places close up to its summit. These same deposits are in the same chain sometimes overlain by volcanic products, whereas on the slopes of the northern chain they do not ascend more than a few yards above the sea. From this it follows that the western Cordilleras, running north-south, belong to the epoch which immediately preceded that in which man had his origin—viz., to the Tertiary.

Bolivia.—This country, now shut out entirely from the sea, has during the past six years been compelled to transmit and receive its commerce principally overland *via* the Brazilian town of Corumba, a small place on the Upper Paraguay. Railway communication is not yet established, either between Tarija and the Argentine railway system, although the line from Tucuman to Jujuy was in the middle of 1886 completed as far as San José (Metan), or with the Peruvian line from Mollendo to Puno on Lake Titicaca. An expedition was undertaken in June 1886 by Capt. F. W. Fernandez, of the Argentine Navy, and an engineer, Dr. C. Thompson, which had for its object to search for a stream, called by the Indians Araguay-Guazu, and reported to flow through the Bolivian portion of El Gran Chaco, to join the Upper Paraguay. Proceeding up this last-named stream in a small river-steamer, Capt. Fernandez turned into Lake Naro, the embouchure of which was 985 yards wide, and had a powerful current, with a depth beyond the reach of the sounding-lead. Towards the north this lake became contracted into a channel, about 328 yards wide and 23 feet deep, which soon split into two arms. The left or southern arm, the mouth of which was choked with a species of grass or rushes (*camalot*), was the Salado, a river with a feeble current. The right and broader arm became lost, about 1100 yards further up, in a sort of valley of this grass (*camalot*), out of which the water gushed at a considerable rate, forming whirlpools. But here the mouth of a river, flowing with some strength of current, was soon discovered. At first the sounding-line indicated depths of 17, 13, 10½, and 23 feet, and then it ceased to touch the bottom. Both banks, situated about 6 or 7 feet above the niveau of the stream, were thickly forested. The water began to assume an increasing tinge of red, and during the whole of the following day no bottom was found at 36 feet. After proceeding about 84 miles up stream, the little boat was turned round and the return journey commenced. Capt. Fernandez and Dr. Thompson are of opinion that this river is the principal arm of the Pilcomayo, and for the following reasons:—Because it comes from the west; because its water is of a pale reddish colour, its rate of flow nearly 5½ miles an hour, its average depth not less than 18 feet, its average width 262 feet, its banks 5 to 10 feet high, and its bottom is of sand. The river is very tortuous, but it can be navigated at all seasons of the year by steamers 100 to 120 feet long. This river the

explorers identify with that which they sought, viz., the Araguay-Guazu. It is called along its course the Caré, and at its confluence with the Paraguay, south of 24° 47' S. lat., the "Laguna Naro."

Heights of Ecuadorian Andes.—From Mr Simson's book on Ecuador, reviewed on another page, we take the following names and heights of twenty Andean peaks in Ecuador :—

	Feet.		Feet.
Chimborazo, ...	20,697	Cotocachi, ...	16,288
Cotopaxi, ...	19,493	Quilindaña, ...	16,134
Cayambe, ...	19,155	Corazon, ...	15,796
Antisana, ...	18,880	Guagua Pichincha, ...	15,701
Altar, ...	17,735	Saraureu, ...	15,700
Sangay, ...	17,460	Rumiñagui, ...	15,603
Iliniza, ...	17,400	Rucu Pichincha, ...	15,537
Carahuirazo, ...	16,748	Quilimas, ...	15,452
Tunguragua, ...	16,685	Imbabura, ...	15,029
Sincholagua, ...	16,360	Cerro Hermoso, ...	15,009

All are volcanic except Saraureu and Cerro Hermoso. Quito lies 9348 feet and Riobamba 9148 feet above sea-level.

Province of São Paulo, Brazil.—The *Bulletin de la Société Royale de Géographie d'Anvers* (vol. xi. fasc. 3) contains a long and interesting paper on the province of São Paulo, in the south of Brazil, from the pen of M. A. Baguet, Belgian Vice-Consul in Brazil. After giving a general geographical description of the province, he treats at considerable length of the industrial, commercial, and agricultural features connected with it. In respect of agriculture, São Paulo is one of the most productive and flourishing provinces of the Brazilian Empire. This favourable state of things is attributed mainly to the richness of the soil, the construction of railways, the navigability of the rivers, and, above all, to the industry and intelligence of the inhabitants, who consist very largely of Germans and Italians. At the end of 1885 the former numbered 180,000 and the latter 300,000, out of a total of 575,000 immigrant colonists.

Basin of the River Cachapoal, in Chili.—The river Cachapoal is the principal tributary of the Rio Rapel, whose mouth lies south of 33° 54' S. lat., on the coast of Chili. The Cachapoal has its origin in three feeders, two of which—the Rio de los Piuquenes and the Rio de los Piuquencitos—spring up in an immense glacier 11 or 12 miles long, and about two miles wide. This glacier fills up a broad caldron-shaped valley, and is fed by an ice-stream that comes from the north-east through the Cañon de los Piuquenes, and by a second glacier that emerges from the Cañon de los Piuquencitos. The Piuquencitos stream issues from the glacier at an altitude of 8038 feet, nearly half a mile to the west of the Rio de los Piuquenes. In the mountain mass whence these glaciers are fed occur summits that rise to an altitude of more than 16,500 feet. This same mountain knot sends down its snows to form other glaciers on the south and south-west—viz., the Bañitos glacier, out of which springs the Rio de los Bañitos, the first right-hand tributary of the Cachapoal, and a second glacier, situated to the north-west of the Bañitos glacier, in which the Rio del Pangal, another right-hand affluent of the Cachapoal, is reputed to have its origin. The third feeder of the main river—the Rio de Molina—comes from the south, and passes underneath part of the great glacier. The united stream traverses first the Cañon de los Vegas, where it has to make an S-shaped sinuosity through a mass of glacier *débris*, towering from 1000 to 1300 feet above its bed.

The first tributary which the Cachapoal receives from the left-hand bears

the name of Rio de los Leñas, which originates a little to the south of the Arriazza Pass (13,270 feet) leading from Chili into the Argentine Republic. From its source the Leñas flows at first due north through the Cañon de Arriazza; then it bends round almost due west and follows the Cañon del Yeso to the Lake del Yeso; and from this point it goes north-westwards through the Cañon de los Leñas to join the Cachapoal. (It is characteristic of rivers in this region to traverse cañons bearing different names, whilst the river itself retains one appellation all through.) The next tributaries that have to be noticed are the Rio del Cortaderal and the Rio de los Cipresos (or Cypress River), both of which originate in glaciers, and both of which join the Cachapoal from the left or south. The lower side of the glacier out of which the Cortaderal issues is about 8200 feet above sea-level, and is mainly fed by the snow-fields of the Cerro Nevado. Flowing at first in a north-north-east direction, the Cortaderal, on being joined by its affluent, the Rio Colorado, from the right, turns to the north-north-west, and, after passing through the long narrow Lake de los Pejereyes and Lake de la Matancilla, it eventually reaches the main stream. The Cañon del Cortaderal exhibits from Lake de la Matancilla upwards to its source, plain evidences of former extensive glacial action. The Cypress River has been sufficiently described in Dr. Güssfeldt's articles in German geographical periodicals of the years 1883-1885. Accordingly, Dr. A. Plagemann, in his paper entitled "Das Andine Stromgebiet des Cachapoal," in Bd. 33, iii., of *Petermann's Mittheilungen* for 1887, from which this abstract is taken, gives no account of it; nor of the lower course of the tributaries of the Cachapoal.

The same paper concludes with some notices of the principal mountain passes by which communication is maintained between Chili and the Argentine Republic. The following are the names and situations of the more important, with the Chilian provinces from which they lead:—

Pass.	Situation.	Province.	Pass.	Situation.	Province.
Planchon, .	35° 11' S. lat.,	Curico.	Calderon, .	31° 16' S. lat.,	Coquimbo.
El Portillo, .	33° 50' "	Santiago.	Hurtado, .	30° 30' "	"
Rio Cocorodo } (Uspallata), }	32° 50' "	Aconcagua.	Ribadavia, .	33° 0' "	"
Los Patos, .	32° 24' "	"	El Carmen, .	29° 0' "	Atacama.
Alicahue, .	32° 20' "	"	El Transito, .	28° 45' "	"
Cuncumen, .	31° 54' "	Coquimbo.	Los Juntas, .	28° 0' "	"
			Los Puquios, .	27° 10' "	"

Expedition to Tierra del Fuego.—Signor Ramon Lista, an official of the Argentine Admiralty Office, has been commissioned by the Government of that Republic to explore the Argentinian portion of Tierra del Fuego, included between Cape Espiritu Santo on the north and Aguirre Bay on the south. His attention will be mainly directed to the survey of the rivers which flow into the Atlantic, the exploration of the coast regions, and of the industrial sources of the interior. —*Comptes Rendus de la Soc. de Geogr.* (Paris), No. 6, 1887.

Gold in Tierra del Fuego.—M. Charles Rouvier, the French representative at Buenos Ayres, communicated to the Paris Geographical Society last November information that valuable deposits of gold occur in Tierra del Fuego, principally in the vicinity of San Sebastian Bay. We also learn that a productive auriferous region has been discovered in the extreme south of Patagonia, and is now being worked. It extends from the Rio Santa Cruz to Magellan Strait. Two villages—Gallegos and Virgenos—have already sprung up.

OCEANIA.

Mauna Loa (Hawaii Islands).—This volcano was again in eruption in last

January. The outburst of lava has taken place on the south-west side of the mountain, about 20 miles from the sea. The lower end of the fissure from which it proceeds is 5700 feet above sea-level. The actual eruption, which began on the 18th January, and lasted until 2d February, was not announced by any premonitory symptoms, and has not occasioned any serious damage. The last outbreak occurred in 1881.—S. E. Bishop, in *Science*, March 4, 1887.

MISCELLANEOUS.

Colonel Gilder has returned from his journey to Hudson Bay, and given up for the present his plan of reaching the North Pole by this route. Mr. Macarthur has also abandoned his plans.

A Royal decree in the Madrid official Gazette of 7th April places all the **Saharan Coast** between Capes Blanco and Bojador under the Governorship of the Captain-General of the Canary Islands. The Sub-Governor of these possessions, the decree states, shall be entitled to be political and military Sub-Governor of Rio de Oro, and shall be an officer of the army. The importance of this step on the part of Spain is considerable. She secures a footing over a stretch of territory extending from 200 to 300 miles in length.

Dr. Carl Peters, the President of the German East African Company, has left Germany at the head of an Expedition to **East Africa**. Considerable importance is attached to this expedition, which may be regarded as a sort of climax in the colonising activity of the German East African Society. A Roman Catholic Missionary Society has been established in Bavaria for the purpose of evangelising Germany's East African colony. Next month, it is intended to send out twelve lay brethren as missionaries.

The expedition under **Major Paiva Andrada** (*vide* vol. ii. p. 623) has terminated in the appointment of that officer to the Governorship of Manica. He travelled as far as Mussurise, the kraal of Umzeila's successor, and there stopped some time, taking a leading part in the negotiations that were being carried on between the local authorities and that chief. Political circumstances then seem to have made it advisable for him to accept a permanent position of influence in the country rather than continue his journey, and the post of Governor was offered him by the Lisbon Government. As Major Andrada is fully alive to the advantages of the exploration of the country, good work may be expected from him whilst he is at Manica.

According to a correspondent in Rotorua, who writes to the *Auckland Evening Star* of 2d March, a new **White Terrace** has been discovered in the Waiotapu Valley, 13 miles from Rotorua. It is situated in a valley 6 miles in length and one in width, which is seldom visited, and which is now being surveyed by Mr. Blythe, the Government Surveyor. "Of course," says the correspondent, "the terrace itself has been known to exist, but we were unaware of its present condition until Mr. Blythe came across it in the course of his work. Two and a half miles from Mr. Blythe's camp are situated the terraces, for there are really two, although I have not as yet had time to inspect the second one. The one I visited the natives called Ko-Kotore-Kaeramua, the meaning of which I have not yet been able to ascertain. As far as I could roughly guess, this unpronounceable terrace is some sixty feet in width at the top, and at the bottom has a curved sweep of about a hundred yards. In general shape, it somewhat resembles the old terrace, but the height is wanting; that will come as the structure forms. The glittering fretwork is not there, but that is also a

thing of the future. It does not possess the lovely coral-lipped basins, but they will, I think, be not long in making their appearance. In this respect, Nature might be assisted by the handiwork of men. It appeared, on the day I saw it, of a dirty grey colour, but I am informed that when the lakelet on the top overflows, it washes the terrace, and makes it of a lovely white, as of old. A stream of hot water is constantly flowing over it. At one side of the lakelet on the top there is a bright yellow pool, tinged slightly with green around the edges, owing to its contact, I suppose, with the blue water of the top basin. At the base of the terrace there is a similar pool set in somewhat similar surroundings. Both pools looked exquisitely pretty in contrast with the blue water as the sun shone brightly down upon them. A question now presents itself, namely—how fast do the terraces grow? Some authorities say they take centuries to form; others years. It will be interesting to watch our new terrace which has passed successfully beyond the embryo stage, and bids fair to equal in beauty of formation and surroundings the old time structure."

NEW BOOKS.

The Geographical and Geological Distribution of Animals. By ANGELO HEILPRIN. London: Kegan Paul, Trench, & Co., 1887.

The distribution of animals over the earth is a study which must always have a great fascination for the naturalist. To the general reader—at least to one who has given any attention at all to the study of nature—the peculiarities in the way of distribution of life, as they are now and again revealed by the researches of the *savant*, or the observations of the traveller, cannot fail to attract some share of interest. And this question of geographical distribution is beginning to be more clearly understood, now that the doctrine of evolution is recognised, and the solution of every difficulty no longer relegated to the once popular dogma of independent creation. The various, and in many cases seemingly insignificant, facts recorded from time to time at length begin to have some significance. Humboldt found insects on Chimborazo, at a height of 20,700 feet—butterflies were seen by the naturalists of the *Alert* and *Discovery* as far north as the 83d parallel. Darwin observed a locust 370 miles from land, and a hawk-moth was captured 250 miles at sea. These facts are no longer simple curiosities of natural history, but are part of the chain of evidence put together with labour and care by the writer of such a book as this. Although many of the laws which regulate the distribution of animals are beginning to be comprehended, there are still enough of strange anomalies to puzzle the student,—the restricted range of some animals, and the almost unlimited distribution of others: while some roam from the tropics to the regions of snow and ice, the range of others seems to be restricted by a ridge of mountains or some insignificant river. As examples of restricted distribution, the author cites the case of the water-mole, found only in the Northern Pyrenees—the buschbok, found only in Natal—the cactus-wren, confined exclusively to the Isthmus of Panama—the red bird-of-paradise, found only in the small island of Waigiu. Some species of humming-birds are found only on the peaks of Chimborazo and Pichincha: one species has been found only once during the period of forty years, since its first discovery. Of species having a broad distribution are mentioned the African elephant, which is found over the greater part of Africa; the tiger, whose domain extends over the entire

east and west of Asia, from the Caucasus to Saghalien ; the leopard, which ranges over all Africa and most of Southern Asia ; the American panther or cougar, whose territory extends from Canada to Patagonia. Of birds, the fish-hawk has probably the most extensive range, with the peregrine, the barn-owl, and the raven. These inhabit the greater part of all the continents. As a rule, the areas inhabited by a given species are continuous, but there are many exceptions,—as the chamois, which is found on the Pyrenees, Alps, Carpathians, Caucasus, and the mountains of Greece,—widely-removed habitats. The hippopotamus is found in the Nile, Niger, Senegal, and most South African rivers, between which stretch vast arid plains, which the animal could not cross. As in the case of the chamois, it is probable that distribution took place from a central area. The discontinuous areas of habitation are very remarkable. A South European variety of the common marsh-tit is found in China, but is entirely wanting in the intervening tract of 4000 miles. A kind of kingfisher is found in the Himalayas and Japan, not in China ; and the Darjeeling pigeon and a kind of fly-catcher are absolutely confined to the Himalayas and the island of Formosa. The marsupial animals, with the exception of the opossums, are confined to the Australian continent and adjacent islands. The opossums are found in both North and South America, but in the continents of Europe, Africa, and Asia, no representative of the marsupials is found.

These, and many interesting facts relating to the conditions affecting distribution, climate, food supply, etc., have been collected by the author, and presented in a most readable form. Since Wallace wrote on geographical distribution, we have seen no work on the subject which gives such an amount of information in such an attractive shape.

The Ocean, Atmosphere, and Life: A Descriptive History of the Phenomena of the Life of the Globe. By ÉLISÉE RECLUS. Edited by Professor A. H. KEANE, of University College, London. Illustrated with above two hundred woodcuts in the text, and twenty-eight maps printed in colours. Pp. 500 + xii. London : J. S. Virtue and Co., 1887.

This is a translation of the second volume of Reclus' well-known work *La Terre*, with additions interpolated, apparently intended to supply the latest information on the various subjects treated of. Like the original, it is divided into three parts, dealing with (1) the Ocean ; (2) the Atmosphere and Meteorology ; and (3) Life.

The first chapter, or "General Considerations," has been enriched by the insertion of portions of Mr. John Murray's address on "The Great Ocean Basins," delivered before the British Association at Aberdeen in September 1885, which occupy as much space as the translation of the original chapter. Since this address was a summary of our oceanographical knowledge, including the results of the *Challenger* observations, it would have been difficult to find a more fitting introduction to the present volume ; but we think the editor might have taken more care to indicate the extent of the new matter included in his work. For instance, the whole of page 29 is taken bodily from Mr. Murray's address above-mentioned, but there is no indication of its being other than the translation of the original work ; while on pages 25 and 26 the quotation marks are placed at the end of the first paragraph, whereas the quotation (from the same address) extends to the end of the chapter. The same laxity in acknowledging the extent to which the book is indebted to recent writers is also observable on page 32 and elsewhere.

The avowedly new matter introduced includes nearly the whole of Mr.

Murray's address, interspersed throughout the volume ; an account of a practical method, proposed by Mr. Frank Della Torre, for preventing collision with icebergs in a fog, which consists in obtaining an echo by means of shots fired from a gun with a speaking-trumpet attached to the muzzle ; Mr. Karl Pettersen's views and conclusions on the formation of the Norwegian fjords ; the Hon. Ralph Abercromby's observations on the clouds and wind-currents over the Atlantic "Doldrums ;" extracts from a criticism in *Nature* of Professor Loomis' book, referring to the rate of progress of storms and the movement of cyclones ; a quotation from Keith Johnston's *Africa* on the distribution of rain over that continent ; the observations of an anonymous writer in *Nature* on the relations of plants to their environment ; a quotation from Mr. H. O. Forbes' *Wanderings in the Eastern Archipelago*, referring to the supposed profusion of brilliant flowers in the tropics ; a note from Mr. W. B. Hemsley's "Report on the Botany of the *Challenger* Expedition" regarding the dispersal of plants by oceanic currents and birds ; an extract from Mr. A. R. Hunt's paper "On the Influence of Wave-currents on the Fauna of Shallow Seas ;" a portion of Professor H. N. Moseley's paper on "The Fauna of the Sea-shore ;" and Professor W. H. Flower's classification of the races of mankind.

A defect, in our eyes, is the omission of the foot-notes referring to the works consulted by Reclus, which are so conspicuous and useful an adjunct to the original work. It would not have entailed much extra labour to have inserted these foot-notes, and it would have greatly enhanced the value of the book to those English readers who have not the opportunity of consulting the original French edition.

The illustrations are evidently reproduced from the original plates and wood-blocks, with the lettering adapted to the English edition. Some of them have consequently suffered a little in clearness, but on the whole the illustrations are excellent, and add very much to the attractiveness and utility of the work.

Considering the wide range of the subjects treated of, it would be futile to attempt to enter into any detailed criticism in the space at our disposal. Reclus is an authority in Physical Geography, and his work *La Terre* is a standard book of reference, a fourth edition having been published in 1877. Professor Keane and Messrs. Virtue are to be congratulated on the success that has attended their labours.

Should a second edition be called for, we would suggest to the editor the desirableness of bringing the information down to the date of publication, by the insertion of summaries of the recent contributions to the various sections of the subject-matter of the book, giving references to the papers consulted for the benefit of those readers who might wish to make a deeper study of any of the subjects touched upon. We confidently recommend the book to all those interested in physiographical science.

Von der Weichsel zum Dnjepr: von Sarmaticus. Hannover: Helwingsche Verlags-buchhandlung, 1886. Pp. 328.

If there be any one for whom Bismarck, Moltke, Krupp, and the German armies have not effectively and finally blown into space the time-honoured idea that the German is a contemplative, unenergetic personage with an innate incapacity for doing much but evolving hypotheses out of his inner consciousness, let him read this book, *From the Vistula to the Dnieper*, which is described as a study in the geography and military history of the wide stretch of country on both sides of the frontiers of Germany, Austria, and Russia—mainly Poland and Western Russia. Here may be seen much of the German

wide-awakeness, acute observation, thoroughness and precision, which make themselves felt not merely in science and war, but of late very specially in commercial enterprise. The book is practically a full, true, and particular account of all the matters most necessary to be known by Germany for a swift and overwhelming invasion of Western Russia by German armies—all the local information that a general assembly of the oldest inhabitants of this wide region could communicate if skilfully cross-questioned by most inquisitive and competent authorities. The climate, summer and winter, of the hills, valleys, and swamps; the physical features and conditions, in full detail, of every corner of the area; its rivers, with their tributaries, and the bridges and fords upon each and all of them, are most elaborately and methodically discussed. The ethnography is a remarkably exhaustive and interesting statement of the various classes of the population—Poles, Great Russians, Little Russians, White Russians, Lithuanians, Jews, Germans, with their social and political sympathies and antipathies. The topography, statistics, and productions of all the administrative divisions, one by one, are gone over with painstaking care, so that a German commander might know where precisely he would be most likely to get horses, beef and mutton, corn, and other supplies most readily; where he might count on some more or less open sympathy from natives; where he would have to rely on the Jews for daily necessities of the commissariat; and where he would have to trust mainly to biscuits and Australian tinned beef. The special military features are of course always kept in view—fortresses, railway connections, roads, and districts specially difficult to pass. Then there is a history of all that befell in these parts during the wars of 1792-9, in 1806-7, 1812, and 1831, in so far as the course of military operations were affected by local circumstances. These, and a thousand things besides, are handled in a clear and succinct manner, and the whole is elucidated by a general map and fourteen sketch maps, based mostly on the Russian and Austrian military maps. In short, the book seems to be a marvellously complete *vade mecum* for the invading Germans, if unhappily that war should occur between Russia and Germany which has been so often prophesied, and which we earnestly hope may be postponed—at least till the information so diligently amassed here has been hopelessly antiquated by the lapse of ages.

Haifa; or, Life in Modern Palestine. By LAURENCE OLIPHANT.

Edinburgh and London: William Blackwood and Sons, 1887.

Haifa is the port of Carmel, ten miles south of Acre, the two forming the extreme points of a famous bay and strip of coast, where of late many colonists of different European races have settled. The latest dream of our charming countryman, Laurence Oliphant, drew him from the social attractions and politics of Piccadilly to a brotherhood in America, and thence to one of those communities on the slopes of Carmel—happily for those who delight in a pleasant book. Here, in a series of letters to the New York *Sun*, he has produced a most refreshing contrast to many of the travellers' books with which ephemeral literature is afflicted. His own powers of observation, unique experience of half the world, and delightful style, here combine with the latest results of the Palestine Exploration Society, to give us a picture of Palestine,—the land and the people as they are. This much-travelled writer pronounces Palestine superior as a residence to any other land, and he would have all, Christian and Jew, help in its colonisation as far as the Turkish Government allows.

Professor Christophe Hoffman of Wurtemberg, disgusted at the failure of

the Lutheran Church to deal with Rationalism, and believing that the Second Advent is at hand, when Christ will appear in Palestine, formed "The Temple Society," who support a German colony at Haifa; another at Jaffa, joined by Second Adventists from America; a third at Saron, and a fourth near Jerusalem. One of the Haifa settlers—evidently Mr. Oliphant—from that spot, travelled all over the land, and reports the latest facts from Galilee and Tiberias to Jerusalem and Jericho. He has two letters full of interesting anecdotes of General Gordon, who visited him at Haifa. He sketches the projected railway—called the Hamidié line, after the present Sultan—from Acre over the plain of Esdraelon, past Nazareth and the Sea of Galilee, to Damascus. He discusses the projected canal from Haifa through Esdraelon to the Jordan and Red Sea at Akaba. Why does not he himself write the hand-book, for which he calls, to supersede the present stereotyped guide-books which ignore the latest discoveries?

The Sources of the Mississippi: their Discoverers, real and pretended. A Report by Hon. JAMES H. BAKER, read before the Minnesota Historical Society, February 8, 1887. Pp. 28. St Paul, Minn., 1887.

This is a report on Capt. Glazier's claim to have discovered in Elk Lake the sources of the Mississippi River (see vol. iii. pp. 105-6). The tenor of General Baker's pamphlet will be best gleaned from the wording of one of the resolutions passed by the Minnesota Historical Society: "We assert our unqualified belief, based on the thorough and careful investigations of Nicollet, O. E. Garrison, and others, and again, more recently, of those made by Hopewell Clarke, that the lake which Capt. Glazier asserts is 'the true source of the Mississippi River,' is *not such in reality*, but that the real source of the river is Lake Itasca and its tributaries, arising in sections 27 and 28 of the township in which it is located."

Another short pamphlet (8 pp.) on this vexed and tiresome question, entitled *Captain Glazier's Claim to the Discovery of the Source of the Mississippi River*, extracted from the *Magazine of Western History*, March 1887, by A. J. Hill, lies before us. Mr. Hill calls special attention to the visits made to the district of Lake Itasca by the Brothers Morrison in 1803-4, C. Lanman in 1846, O. E. Garrison in 1880, and Rev. J. Gilfillan in 1881, all of whom seem to have known of the existence of the lake, and all of whom preceded Captain Glazier.

Notes of a Naturalist in South America. By JOHN BALL, F.R.S., M.R.I.A., etc. 8vo, 416 pp., with map. London: Kegan Paul, Trench, and Co., 1887.

This volume contains the valuable record of an interesting journey. The author's route led him through places but little frequented by those who have leisure or ability for scientific observation. He touched first at Barbadoes and Jamaica, thence crossed the isthmus of Panama, sailed down the western coast of South America, through the Messier and Sarmiento Channels and Magellan's Strait, returning home by the eastern shores of the continent. Mr. Ball is a cultivated and enthusiastic botanist, and his book teems not only with records of the plants seen and gathered on his journey, but also with comparative remarks on the origin and relations of the different floras. He is, however, much more than a botanist; he has an eye for all the phenomena of nature, and his discussion of the climate of the Cordillera is a valuable contribution to a difficult meteorological question. The work is illustrated by a useful and well-executed map, and will be studied with great profit by any who propose to visit the same regions. A lack of striking incident will perhaps prevent the volume from becoming widely popular, but it is clearly written and not without a certain

play of fancy, as, when speaking of the tropical flora, he says, "It seemed as if the inmates of the plant-houses at Kew had broken loose and run scrambling up the rocky hills that enclose the valley."

Venezuela: a Visit to the Gold Mines of Guyana and Voyage up the River Orinoco during 1886, with a brief Sketch of the Mineral Wealth and Resources of Venezuela, and its History to the Present Time. With a Map of the Mines, and Appendices. By WILLIAM BARRY, C.E. First Edition. Pp. 159 and lxxviii. London: Marshall Bros., 1886. Price 6s.

From the long and clumsy title of this book, as well as from its price, one would expect a solid volume of some four or five hundred pages. Instead of that, Mr. Barry's production, with all the devices adopted (such as short paragraphs and wide spacing) to spin it out, does not exceed 237 pages in all. The writer would have done better if he had pruned his ambition somewhat, and, leaving historical matters alone, had been content to stick to a description of his visit to the mining centres of Venezuela. He might then have put together a fairly readable magazine article. Furthermore, he might perhaps in that case have found time to revise the proofs of what he had written. In the book before us he seems to have regarded that as unnecessary labour. How otherwise do we find in it such things as the following?—The capital of the country spelt all through, Ciudad Bolivar. "Cassaquiau" (p. 41). "There seems to have been some intention to push on to where the rivers flowed into the Amazon. A very probable determination in the then unknown state of the course of the two great rivers" (45). "The few Indians still found there belong to the tribe of Gouranis. Gouaraona being an Indian name, indicating the mouth of the river" (46). "Donkies" (77). "As his presence and signature *was* absolutely necessary" (144). On p. 137 we have a repetition of what has been said on p. 90 about the falls of Coroni. With respect to the population, we read on p. 73—"What the population now is, it is impossible to say, in 1875 it was about 2,000,000;" yet on p. xxxii. (Appendix C.), he prints this sentence: "The population has also increased from 2,075,245 in 1881 to 2,121,988 in 1884."

Mr. Barry's account of the gold mines of Venezuela, and of the way to get to them, are, however, full of interest for the technical miner, but less so for the geographer. These mines, the richest of which is that of El Callao, lie within the watershed of the river Essequibo and the boundaries of the political state of Bolivar. There exist plausible reasons for identifying this rich auriferous district with that which Raleigh sought for under the magic name of El Dorado. Two of the three appendices attached to this book deal with mining matters. The first is entitled "Report on the Federal Territory of Yuruary, Guayana, and Venezuela, by General Victor Barret de Nazaris, Minister of War and Marine." The second details the articles of the Mining Code, under which the mines are worked and regulated.

England seems to have derived from the former Dutch possessors of what is now British Guiana a plausible claim to the whole of the watershed of the Essequibo, including the entire mining district of Venezuelan Guiana. Mr. Barry's words, when he speaks of this subject, are perhaps worth quoting. He says: "I have it from undoubted authority that the British claim will not extend beyond the mouth of the Orinoco, known as the Boca de Navios, in lat. 8° 30', where still exists (*sic*) the remains of a Dutch fort, called Barima, from a river of the same name. From this point the line of frontier will follow the Amicara River to a chain of mountains touching the point of the Barima River, then from the Imataca mountain range to Acrabisi River, following the Acrabisi

to the Cuyuni River, and this latter up to its source, and continuing the same line through the mountain ridge to Brazil" (p. 132).

Appendix C, "Extract from Report by Vice-Consul Reddan, of the Trade and Commerce of the Port and Great State of Bolivar, and of the Five Federal Territories, Alto Orinoco,¹ Amazonas, Caura, Delta, and Yuruary, for the years 1883 and 1884," constitutes for the geographer perhaps the most interesting part of the book. From this *Report* we learn that the total area of the republic was estimated at 632,705 square miles in 1884, and its entire population at 2,121,988 in the same year (2,075,245 in 1881). Perhaps the most important portion of all Venezuela is the State of Bolivar and its five federal territories. These include an area of 428,376 square miles, and have a population of 822,768 inhabitants. They contain the magnificent waterway of the Orinoco and its numerous tributaries, have thousands of miles of forests, with many precious woods, soil of rich fertility, and immense mineral resources. And of all these things very little is known, mainly owing to the maladministration of the country, and the consequent lack of enterprise in its inhabitants, and of inducement to foreigners of energetic character and with capital to labour for the development of its resources. The roads, too, are in a shocking condition, and everything seems to be done by the Government, not to promote, but to hamper and restrict the movements of trade and the combinations of commerce. Monopolies are numerous; of banks there are none; and the minor administrative officials are both indolent and rapacious.

Travels in the Wilds of Ecuador and the Exploration of the Putumayo River. By ALFRED SIMSON. A Map. Pp. 270. London: Sampson Low, Marston, Searle, and Rivington, 1886. Price 8s. 6d.

This book plunges at once *in medias res*, without any preface, and the narrative runs on in an easy business-like way that at once inspires confidence in the author. Mr. Simson's pages introduce us to the eastern parts of that little-known state, Ecuador; therein he describes his travels in what is known as the "Oriental Province," lying to the east of the two Andean chains. It is a region covered by primeval forests and inhabited by pure Indians belonging to several distinct tribes. But how little is really known of it is painfully apparent from the fact that the map accompanying Mr. Simson's book shows no less than six different frontier lines, mainly on the east, north, and south. (In other respects this map does not afford much help in tracing the author's route; a second more detailed map might have been given with advantage for that purpose.) The Oriental Province embraces the headwaters of the principal affluents which join the river Marañon or Amazon from the north, between 68° and 78° W. long., viz., the Pastassa, the Napo (with its feeders the Curarai and others), the Putumayo, and the Yapura. Travellers proceeding inland from the coast-towns of Ecuador have at first a difficult climb before them; then they have to cross the two parallel ranges of the Andes and the broad intervening plateau; and finally to descend through an exceedingly difficult and pathless country. The route pursued by Mr. Simson led for considerable distances along the beds of rivers, or rather, mountain torrents (Pastassa, Curarai, and Napo), which had to be forded again and again; at other times he had to traverse many miles of dark, damp, tropical forests; and not infrequently it was necessary to travel along the crests of extremely sharp ridges (*cuchillas*), which resemble the upturned edges of knives, and generally run "for a considerable distance, sometimes ten, and even fifteen miles, uninterruptedly, with varying elevation

¹ Mr. Barry makes six by printing a comma between "Alto" and "Orinoco."

up to as much as perhaps 500 feet from the base. On one side they are almost generally perpendicular, and on the other descend at a sharp angle." They consist of loose vegetable earth and loam, covered with thick mats of entangled roots and vegetation. Mr. Simson is of opinion that they are the heavier and firmer portions of matter brought down from the Andes by the agency of denudation, and left standing by the streams, which have carried off the looser and lighter materials that formed part of them. In connection with this it will be interesting to notice another physical theory suggested by the writer. Nearly all the rivers in this region are subject to alarmingly sudden floods; and these rapid rises are of two kinds,—one periodical, depending upon the seasonal changes, and the other entirely irregular and unforeseen. Mr. Simson suggests that, as they have their sources for the most part high up on the slopes of the Andean chains, the unexpected augmentation of their waters may be due to the sudden melting of vast masses of ice and snow by the agency of volcanic or earthquake forces. This seems at any rate reasonable as one concomitant cause of the sudden turgescence of these mountain streams at wholly irregular intervals.

Mr. Simson, who was accompanied by a Hungarian, Mr. Sarkady, was compelled to rely entirely upon the assistance of the native population through whose districts his route lay. The tribes he met with were the Jivaros, the Canelos, the Zaparos, the Pijés, and others; and he gives a good deal of useful information about the habits, customs, and characters of these several peoples. The Indians of the Oriental Province are divided into two broad classes, called "Indians" and "Infidels" (Infiles, Aucas): the former class embraces those who speak Quichua, eat salt, and are partly Christianised; the latter are those who speak their own dialects, and neither eat salt nor have come under the influence of the Jesuits. At the time of Mr. Simson's journey smallpox was raging amongst the Indians along the Napo; and everywhere the natives were fleeing panic-stricken from the scenes of its ravages.

On arriving at Iquitos on the Marañon, Mr. Simson embraced an opportunity which presented itself of ascending the Putumayo or Iça in a small steam-launch. The following is a condensed restatement of his description of this important stream. At its sources the Putumayo consists of two principal headwaters, the Putumayo and, to the south, the Guamués; these a little further south are joined by the San Miguel. The main stream pursues a general south-easterly course, almost parallel to the Yapura and the Napo, over a bed of shingle and rock, at first, with high banks; but they gradually get lower, and in many places the river opens out to an enormous width, forming several channels, separated by large islands and sand, or mudbanks. From Montepa, 900 miles above the Solimoes (Amazon), all is sand and fine mud. The average current is about $3\frac{1}{2}$ to 4 miles an hour. The course of the river is extremely tortuous—straight reaches are few; and a water horizon is seldom to be seen. All the inner (smaller) curves of the banks rise gradually from a low recent deposit, and their vegetation is of a quite different description from the older forest of the outer (larger) curves. In some places the strong floods, instead of following the circuitous windings of the channel, cut a new bed across the tongues of low land forming the inner curves, and in this way most of the islands are formed.

Judging from Mr. Simson's cheerful endurance of the hardships of travel, his tact in dealing with the native Indians, his perseverance, energy, and conscientiousness, as well in observation as in description, he would doubtless make a capital leader of an exploring expedition. We hope, therefore, to hear of him again in connection with geographical work in this part of the world.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

AN EXPLORING TRIP TO LAKE ALBERT.¹

BY EMIN PASHA.

A SHORT distance south of Wadelai the river (Bahr-el-Gebel), which hitherto has been flowing between two parallel ranges of hills in a bed only one-third of a mile wide, suddenly expands to a breadth of nearly two and a half miles. This broad expanse of water is studded with numerous small islands formed of reeds and papyrus, and its shallow bays, even in seasons of high water, harbour herds of hippopotamus. Over all the shallower portions of the basin, swarms of pelicans pursue the business of fishing, and groups of black heron-like *Anastomus* stand in small companies mid-leg deep in the water. Owing to a plentiful supply of good dry wood, the *Khedive* was able to run at high-pressure, and so we reached early the landing-stage of Fagango, the starting-point of the road for Aufina's village. The village of Fagango, which is inhabited by Aluri, lies a short distance back from the river.

The landscape along the river to the south possesses no interesting features, with the exception of the river itself, which is still a majestic stream. The western bank is bordered by a chain of hills, which is for the most part covered with thin forests, and which, whilst generally hiding from sight a second range behind it, that runs down to the lake, yet allows its summits to be visible from time to time. Here and there occurs a solitary *Borassus* palm; but candelabra *Euphorbias* and tall bushes of the *Calotropis procera* are plentiful. The eastern bank is flatter, and is covered with short grass, and planted with a few trees; it is, in fact, of the true savannah type. Everywhere there are large herds of antelopes, and very

¹ Translated from the German by Mr. J. T. Bealby. The original MS. was received by Dr. Robert W. Felkin.

frequently a troop of elephants appeared on their way to pasture or to get water. The banks seldom rise more than one and a half feet above the surface of the stream. Immediately behind the fringe of bushes that line the banks come the durrah fields of the native population, guarded by numerous watch-huts. The country is but thinly peopled. The harvest, in consequence of continued drought and want of rain, did not look very promising.

Shortly after noon we passed the village of Fanigoro, belonging to the chief Okello, which gives its name to this particular district. The village, consisting of scattered groups of huts, generally erected under the shade of the few clumps of trees, is spread over the upper slopes of the western hill-range. Numerous huts appeared also on the east of the river. The inhabitants are Aluri, together with Shefalu-Wanyoro, who, under their chief, Amara, migrated hither in 1879, when we abandoned our station at Magungo. Both languages—Lur and Kinyoro—are consequently spoken here.

A short distance to the south of Fanigoro, the principal mountain range on the west of the lake approaches nearer, and splits into two distinct parallel chains, the nearer one being lower than the one more remote; the latter, however, as it trends away towards the south, is frequently screened from sight behind the former. The eastern edge of the river bed now inclines further and further towards the south-east, the river itself turning slightly towards the west; at 2.30 P.M. we saw the extreme point of the right margin of the river; thence it recedes eastwards to the mouth of the stream that reaches the lake at Magungo.

Entering the lake, we were met by masses of drifting *Pistia* rosettes. We hugged the western shore, and soon reached the district of the chief Boki and his village, which bears the name of Fanjimoro. Seen from a distance, this village has a very inviting appearance. Along the foot of the somewhat lofty hills, which bear on their slopes numerous huts constructed in the Magungo style, is a broad low-lying tract, covered with short, succulent green grass, and having several groves of fine trees. Fields planted with ground-nuts and maize, small herds of cattle and goats quietly grazing, groups of people industriously weeding and sowing, women washing at the river, with little children playing around them—all this made up a picture of peace and prosperity such as, unfortunately, is seldom seen in this part of the world.

On hearing the signal of the steamer, the people at once brought together a quantity of dry wood, but to get it on board was a labour attended with some difficulty; for in the first place the boat, owing to the shallow water, could not get close inshore, and in the next the people found it not easy to wade through the lake with the heavy beams on their heads, in consequence of the strong wind that was blowing. The chief, Boki, an old acquaintance, came to us in a boat propelled with oars of bamboo, and begged us to take some bamboos from him to Kibiro for Kabrega—a strange request, because bamboos grow plentifully in Kabrega's

own country. The chief did not, however, stay long; the rolling of the steamer did not seem to be quite to his taste.

The wind was meanwhile beginning to blow stronger; and, seeing the difficulty experienced in getting the wood on board, we deemed it advisable to steam on to the wood-station, a little further to the south, and there take in, early on the following morning, a sufficient supply to last us all the way to Kibiro and back, for no wood was to be obtained at that place. Accordingly we steamed first south, and then south-west, parallel to the mountain range. The foreshore in this part is well wooded, and the chain of hills runs up into some peaks of considerable elevation, whilst beyond them we saw now and again the summits of the more distant range. The flanks of the hills were very scantily wooded. Owing to the heavy pitching of the boat the journey was not a pleasant one; my people have no idea of the utility of ballast. Twice on the way we met enormous shoals of small fish, apparently proceeding northwards. The water of the lake was for a considerable distance coloured by them a light-bluish green, and their continual movements occasioned a kind of bubbling, and at times much splashing. Here also large masses of *Pistia* were observable, likewise going northward.

Half-an-hour's steaming brought us to the wood-station, a thick forest of considerable extent, on the edge of which, close by the lake shore, Boki's people have erected their huts. Here, in spite of all our foresight and precautions, we had a bad night of it; a kind of cyclone raged from midnight till morning, and several times made us anxious about the steamer. Early next morning all hands were got to work at felling trees, and the inhabitants of the place rendered first-rate service with their boats in getting the wood on board the *Khedive*. From here the eastern shore of the lake was pretty plainly visible as a chain of hills having a north-south axis. When the mist cleared off, we also saw another distinct mountain-mass situated further north; this I concluded was Jebel Gbeissi, near Kiroto. An expedition into the forest on shore did not reward us for our trouble, and we were soon compelled by the buffaloes to return.

The trees we felled in this locality were mostly *Diospyros nespiliformis*, an excellent material for firing purposes, and one that is greatly liked for building. It has a fresh reddish colour, and a pleasant smell; when felled it soon assumes a beautiful darker tint. It resists the attacks of termites pretty well; yet it did not answer, we found, for boat-building. But it serves excellently for making gunstocks, especially when it has been buried for some time in the ground. I also observed another sweet-smelling species of timber amongst the firewood brought on board, but I could not ascertain from what tree it came. I am inclined to think that it is a species of *Vitex*.

All along the river and in the lake I was struck with the relatively small number of species of water-birds. Further north, in the Bahr-el-Abiad, between 12° and 15° north lat., water-birds and marsh-birds occur in innumerable flocks, while to the south, in the localities mentioned, one

cannot find a single duck or a single goose. And although we can explain this marked difference for the winter season (November to March) at least, by the fact that large numbers of European emigrants on their way to the south do not proceed beyond the marshy track between Sobat and Ghaba Shambé, still this will not account for the paucity of species, and of members of species which do occur, in localities that are so eminently suited for them, further south. *Ardea alba* and *A. comata* went on fishing around the steamer, quite regardless of the bustle; and a little further away I noticed specimens of *Anastomus lamelligerus* (stork), *Plotus Levailanti* (Le Vaillant's darter), and *Phalacrocorax africanus* (cormorant). A few jabirus (*Mycteria senegalensis*) were searching an inundated low-lying piece of land; and on the margin of the lake a few Egyptian geese (*Chenalopez aegyptiacus*) showed themselves. With the pelicans mentioned above as having been observed in the river, I close the list. Not a single plover was seen, nor yet a single strand-snip or a duck.

By noon we had got enough wood on board, and with a very fresh wind we steamed, at about one-third of a mile from the shore, towards the south, having the western hills on our right. In height these range from 1310 to 1640 feet; they are for the most part thinly forested, and their sides are largely seamed with watercourses; thickets of bamboo appear in places. The watercourses, however, are little more than rain channels, and even in the rainy season they are often dry. Their direction is shown by the denudation and seaming of the hill-sides, and by the scattered blocks of stone; they have, of course, in most cases followed the natural foldings and crevices of the rock. The foreshore, the width of which alternately increases and diminishes, is for a short distance well inhabited; but further towards the south the huts disappear, and park-like land is intermingled with fine groups of trees, patches of desolate grass, and dense forest. On the east the mountain chain was scarcely visible, owing to the veil of mist that enveloped it.

After less than an hour we came upon a long spit of sand, in the shape of a crescent. On keeping well to the west, we soon perceived that it was an island, and came to anchor at about 50 yards from its shore. This island lies somewhat further south than our deserted station of Mahagi, which we recognised from three large trees growing there. Immediately behind Mahagi the western chain of hills descends with a gentle slope, and the more distant range behind comes into view. This last contains summits of considerable altitude, which may be compared with Jebel Eruku, and still further south it has yet higher peaks; the entire range is called by the Negroes, from the country behind it, the Mountains of Lendu. The island, off which we lay, is separated from the mainland by a narrow channel, which was not deep enough for the steamer. To judge from the great quantity of mud in it, this channel will ere long be quite filled up; meanwhile it is kept open by the strong current that is driven through it by the powerful south wind.

The island in its present crescent shape, with its hollow on the

north side, is of quite recent formation, for in 1879, as we noticed whilst going across from Mahagi to the hot springs of Kibiro, the spot where it now lies was covered with shallow water. It was therefore formed within the space of about five years, for it has been already occupied for two years. Its maximum length, from horn to horn, measures 1067 yards, and its maximum breadth 99 yards; its greatest height above the level of the lake is about $6\frac{1}{2}$ feet. Its shores, which are flat, and slope gradually down to the water, consist entirely of drift sand, and surround a firmer centre of rich dry mud. Tall grass and reeds grow at the water's edge, and on the higher parts, and at its extremities, a species of acacia (*A. mellifera*). A multitude of black-headed weaver-birds (*Hyphantornis dimidiata*) were flitting about the island; numerous little fly-catchers (*Muscicapa*) clung to the stems of the reeds; a flock of *Phalacrocorax africanus* were sunning themselves on the margin of the water; and close by them some huge crocodiles were lazily basking in the sun. These creatures seem to abound in the neighbourhood; we afterwards killed one which measured $11\frac{1}{2}$ feet in length. Turtles of great size must also be plentiful in these waters; at least I infer so from the large eggs which we found so abundantly everywhere; but of the animals themselves I never succeeded in getting possession of a single one.

The origin of this island, to which the natives give the name of Tuguru, admits of easy explanation. The large volume of water contributed to the lake by the two principal feeders which join it in the south-west—viz., the Nyussi-Msisi and the larger Duéru¹—goes principally towards the east side, so that the detritus and sediment which those rivers bring with them in suspension are deposited on the west side of the lake. In the case before us this process is largely aided by a projecting point behind the island arresting the rain, and facilitating its precipitation. From what I have observed of the lake, I am inclined to believe that the foreshore on the west is gradually encroaching upon its waters; in other words, the lake is in this part gradually filling up.

The chief of the district Mahagi is my old acquaintance Songa, a trusty and reliable man, who came to pay me a visit late in the evening. On receiving a few small presents, he made many apologies for coming empty-handed; my arrival had taken him completely by surprise. All Negroes must not be set down as drunken good-for-nothings and beggars. The entire population of the west shore, from Okello's village, Fanigoro, right down to the recently subjugated land of Mboga, acknowledges the supremacy of Kabrega. This prince maintains relations of close intercourse with the several chiefs of this region by sending them from time to time small presents of Zanzibar cloth, or a few pieces of finer bark-cloth, which is imported from Uganda, and is greatly esteemed in this country. In return for these presents the subject chiefs do not, apparently, render any fixed services; but in Kabrega's last war against

¹ See the extract from Emin Pasha's letter below.

Uganda they gave him great assistance by sending supplies of arrows, lances, and shields. Kabrega has also on occasion complied with the request of the Aluri chiefs, and sent some of his men across the lake to aid them in making raids into Lendu, over on the other side of the hills.

Mahagi is an exceptionally healthy place, and is particularly well adapted for gardening and agriculture. The abundance of water in the neighbourhood would greatly facilitate irrigation operations. For the present I have left only very few people there, but I intend shortly to establish a permanent station. Unfortunately the steep ascent, and the impassable nature of the bordering mountain-chains, make communication with the districts to the west very difficult; but perchance a more accessible pass may exist further to the south.

For two days past the aneroid had indicated an abnormal atmospheric pressure, and an attempt to determine the elevation of Mahagi by means of boiling-water, for the purpose of checking previous determinations, was therefore a failure. In the evening it had begun to blow hard; and thunder and lightning, with rain, in the south, held out no promising prospect for the night; the storm kept off, however, until midnight. The steamer rode in deep water, and was protected by the island against the force of the waves coming in from the south, so that the storm passed away over our heads. But about midnight the wind veered round to the east-north-east, and the steamer then became fully exposed to the violent buffets of the angry waters. The rain came down in torrents. To make matters worse, the anchor got loose, and in a moment the steamer was aground, but fortunately in mud and sand. Every time the white-crested waves struck the broadside of the boat they made her heel over. In spite of all our united endeavours we were quite unable to free her from her unpleasant position; but by casting out another anchor and hauling the boat tight, we managed to turn her so far as to present her stern instead of her side to the direct force of the waves; even then she felt the shock through all her timbers.

The storm subsided about five in the morning, and the rain ceased; I at once got all hands to work, threw out another anchor, and forced the boat by steam-power backwards out of the mud. About seven o'clock we got afloat, and, after repairing minor damages, we started half-an-hour later to cross over to the east side of the lake. It was still blowing stiff, and the foam-covered waters beyond the narrow extremity of the island looked anything but assuring. And, in fact, we had scarcely passed that point when the game began; in a very short time a large part of my people were prostrated with veritable sea-sickness; and notwithstanding that the motion of the water, and consequently of the boat, was soon greatly moderated, my suffering companions did not recover until we got under the shelter of the land. Our course was southerly and south-south-easterly, and we frequently passed obliquely through large shoals of fish, which doubtless felt more comfortable in the heaving waves than did the

majority of my people *on* them. In such places the light-green waters of the lake, owing to the refraction of the sunlight on the glittering silvery scales of the fish, assumed an almost bluish-green hue. The fish were indeed so numerous that in less than a quarter of an hour we counted six shoals, doubtless divisions all belonging to one mighty host. On our left we saw the mountain-chain of the eastern shore wrapped in mist. Due east we observed some flat strips of sand, sparsely overgrown with reeds; but whether they belonged to an island or to the mainland we were unable to determine in the mist. At length we approached so close to the shore that we got within sight of a line of hills belonging to the main chain, and presently also of the foreshore lying between it and the lake. The lake side appeared to be without foothills; and green patches, most likely of rushes and reeds, occurred but seldom. The land had a desolate and inhospitable appearance, and seemed to be totally uninhabited. Pursuing a course nearly parallel to the shore, we came, shortly before noon, so close in to it that we could easily distinguish the features of the hill-sides.

These hills are high, and green at the foot; their more elevated parts support a sparse vegetation; but arboreal flora ceases almost entirely, which is perhaps attributable to denudation of the superficial humus by water. But in spots where foldings and corners allow an accumulation of humus to take place, and where the moisture can be retained, there exists a richer plant vegetation, and often even patches of forest. The summits of the hills are mostly either rounded domes or broad flat ridges; sharp pinnacles are visible nowhere. A superficial examination of the northern portion of the chain shows plainly that the entire region at the foot of the hills right away to Magungo has been formed by the lake and the rivers. The low ground between the hills and the lake extends northwards in the form of a triangle, and consists entirely of alluvial matter. The range runs due north, and is connected immediately with the isolated hills of Kiroto and Massindi, which I consider to be the remains of a former chain that has been broken down by atmospheric agency.

As for the lake, I attribute its origin solely to erosion. I think it more than probable that formerly a large stream may have made its way from between the two ranges to east and west of the lake, so that its erosive action, combined with that of inundations, heavy rains, caving-in, and the influence of sun and weather, are quite sufficient to account for the result. The geological formation of both ranges is the same; their altitudes differ but little, and the terrace-like formation of their descent lake-wards is in each case exactly alike. The final decision will, of course, depend upon the examination of the shores, and of the rivers which empty their waters into the lake on the south—work to which I hope shortly to direct my attention.

Shortly after noon we saw at the head of a wide crescent-shaped bay three large villages, all of which are built on the outlying ridges close to the foot of the hills behind; we cast anchor off the southernmost of these, at about 55 yards from land. But as the anchorage gave no shelter

whatever against wind and weather, we had to hold off shore during the day, and at night to go out into deep water. As soon as we anchored, a number of people appeared on shore laden with thin beams of wood—material for firing—but they were agreeably surprised when we told them we did not require it, and only asked for some baulks for our church. Some of Kabrega's people, who had accompanied me from Wadelai and were bound for home, had meanwhile disembarked. Their leader, Msige, now came back on board, along with the chief of the place, Kágoro, who is a stalwart and very dark-skinned fellow, with smooth shaven head, and was clad in the indispensable clean-looking ox-hide, above which he had a piece of new bark-cloth, and in his hand the long staff of authority which marks the Wanyoro chief. Kágoro bore himself with much dignity, and made a favourable impression upon me. After we had exchanged with each other the usual compliments, and he had placed his district at my entire service—as the old friend of Kabrega, I am held in high esteem by the Wanyoro—we landed together, and sent a messenger to Kabrega with despatches for the post to Uganda.

Having expressed a wish to live on shore during the period of my stay in this place, I immediately had the offer of any hut I might choose. But I could find none that would suit me; so, early on the following morning, I begged Kágoro to have a hut and an awning constructed for me; this he at once promised to get done, although, owing to the scarcity of materials, it was a difficult task to accomplish. Late in the evening, I received a sheep and twelve head of poultry as a present, together with the promise of more on the morrow—of course a promise *ad calendas Græcas*. One must, however, in such cases, rest content with the good-will and the smooth words; we could not, indeed, expect the natives, who have themselves to buy all their necessities of life from beyond the hills, to be particularly generous to strangers. Kíbiro, the name of the Central African trading-station before which our steamer lay, produces nothing but salt, and with this its inhabitants have to purchase even their wood for firing.

Along the lake-shore runs a tolerably broad strip of sand, sometimes coarse, sometimes fine, spread over sharp-edged *débris* of stone, and in some places so thickly strewn with the yellowish shells of a species of small snail as to have a quite white appearance. These are the undeveloped outer coverings of two or three forms of which I had already gathered specimens. The bay is entirely surrounded by this girdle of sand; beyond it comes a belt of under-growth on dunes, where grows a species of *Aristida*, that takes the place of sand-grass (*Elymus*), and pricks in a most unpleasant manner. On the further slopes of these dunes we crossed places in which the soil was swept quite bare; heaps of a scoured and finely-pulverised kind of earth, of a greyish-yellow colour; patches in which the soil had been recently moistened, preparatory to being scratched up [for salt]; little pools full of yellowish water; and walls of mud, along the foot of which stood rows of clay vessels ranged on stones placed at regular intervals.

The steadings or kraals of the inhabitants are scattered all along the low foot-hills, being separated from one another by narrow and very dirty passages ; on the whole, they suggest the idea of a tolerably dense population. Each kraal is surrounded by a hedge of bamboo, often in a very defective condition, and contains a number of huts crowded together. They are constructed in the Wanyoro style, with partition walls of bamboo, a raised sleeping-place for the head of the family, the ground stuffed with hay, and the whole interior swarming with fleas. Vast numbers of poultry abound everywhere ; they are a somewhat larger breed than the miniature variety of the Aluri, which again rival in diminutive size the poultry of the Monbuttu. Multitudes of dogs, of a breed something like our greyhounds, and of a liver or liver-and-white colour, prowl about the huts, apparently the property of nobody in particular ; at any rate, they are evidently uncared for, for they are terribly lean, and frequently make forced loans from the interior of the dwellings. Wherever there exists a sufficient quantity of the sparse grass, large flocks of a fine breed of sheep and of goats were grazing, and they seemed to enjoy the vegetation that springs up on the saline soil on the hill-slopes. I saw but one solitary cow ; cattle indeed appear to be extremely rare in this district, or else do not thrive well. Besides, the mountain pasturage would hardly suffice for feeding cattle.

Between the huts and the kraals, and often, too, within them, a few small trees grow separately, mostly *Ficus lutea*, from the bark of which the people fabricate the well-known bark-cloth. These trees are not, however, expressly cultivated here ; but they are so easily propagated and grow so rapidly that a twig stuck in the ground only requires to be kept moist to take root immediately. Close by the margin of the lake stands a single tall, slender *Borassus* palm, whose crown is literally full of hanging nests of the weaver-bird, belonging to the larger species, *Hyphantornis abyssinica*, which is so prevalent further north about Wadelai. Here, too, the bird gave evidence of its very quarrelsome disposition ; for at the foot of the tree lay a great number of destroyed nests and broken eggs, proving that serious combats must often have taken place aloft.

The vegetative covering of the hills is of a peculiarly poor character, recalling that of steppe country and deserted arable land. Trees are very few ; in fact, the sole representatives of true foliaceous varieties were a couple of tamarinds in the middle of the village, on whose branches rested several snow-white herons. The few *Balanites* which occur are small and mean in appearance, and *Zizyphus* does not grow to be more than a bush. A tree-like species of *Euphorbia* (*E. tirucalli*, I presume), as well as tall *Calotropis procera*, and what was to me a new kind of *Datura*, with yellowish blossoms, are, however, pretty frequent. But the characteristic covering of the soil, except where the bare stone comes to the surface, is a species of *Anthistiria*, which, however, is too short to be used for the roofing of huts, and has no particular value as food for animals. At intervals appear, as it were, islands of closely interlaced

prickly shrubs, and round about these are clumps of *Solanæ*, tall *Ocimum* bushes, and some *Leguminosæ*.

These thickets, which are low and impenetrable, harbour multitudes of small birds, among which the loud comical song of the *Cisticola ludoensis*, and the full ringing notes of the *Crithagra leucopygos* (finch), were especially conspicuous. This portion of the lake shore forms undoubtedly part of the steppe zone to which Wadelai belongs, and which includes the entire valley of the Bahr-el-Jebel. As ornaments of every pathway and every track, I may mention the great number of turtle-doves (*Turtur senegalensis*) and the beautiful bullfinches (*Lagonosticta rufopicta*), which fly up from under the traveller's feet at almost every step he takes, and, regardless of the noise and bustle around them, go on searching for their food in the midst of the village and the kraals as boldly as in the thickets in their vicinity. The relative poverty of the flora and its steppe-like character must be set down to the fact that, although the amount of rainfall, like that in Wadelai, is small, taking the year through, yet its occurrence is separated by such long periods of drought that the vegetation has no opportunity to develop. Nor can the moisture, which is engendered by evaporation from the waters of the lake, do anything to promote the growth of vegetation, because it is carried away by the strong winds which almost constantly prevail. Moreover, the humus which covers the stony *débris* is very thin.

Immediately behind the village rises the principal range of hills. The two individual hills which overlook the village are called Rúgoi and Kjente; across these, very steep paths lead to the country on the other side, and to Kabrega's capital. On turning round we have before us the gleaming lake, backed on the opposite shore by a range of hills with a south-west trend.

The bay of Kibiro is rather shallow, and its waters are the haunt of vast shoals of fish, the catching of which gives employment to the natives. In this pursuit they use large canoes hollowed out of bamboo stems, and frequently spend the entire day on the lake. Their oars are bamboo poles and a kind of shovel. In spite of this primitive and laborious mode of progression, these people, especially in favourable weather, not infrequently venture to cross the lake to Mahagi, for the purpose of selling their fish; sometimes, indeed, leaving their boats under the care of Songa, they go over to the other side of the hills, where they find a better market for their wares. It sometimes happens, on these voyages across the lake, that the fishermen suffer much from sudden storms and bad weather, and many of them have gone to the bottom. The fish are generally so imperfectly dried—for although abundance of salt occurs everywhere, nobody thinks of using it for curing fish—that they give out a most unpleasant odour; but this does not seem to render them at all unpalatable to those who consume them. This trade in dried fish is carried on in all the districts beyond the hills on both sides of the lake. The chief species of fish that I myself noticed were small *Mormyrus* and large *Hydrocyon*.

In the neighbourhood of Kíbiro there is not a single square inch of cultivated land ; consequently the place produces no corn, no vegetables, no bananas, etc. Even sweet potatoes, which are an indispensable article of diet in Unyoro, are not planted here, and it is only occasionally that they are brought for sale in small quantities from beyond the hills. Consequently corn of all kinds is a very valuable present, and serves as a most useful medium of barter. All the necessities of life required by the inhabitants of Kíbiro are carried up and down the steep mountain-paths on people's heads ; all the energies of the native population—that is, of the women, for the men are lazy and work very little—are devoted to the extraction and preparation of salt. This constitutes an important industry in Kíbiro, which supplies with salt not only all the northern parts of Unyoro as far as Mruli, but also most districts of Uganda, the Lur country, and the Shuli. The salt deposits of Kíbiro, therefore, constitute one of the most valuable portions of Kabrega's dominions. In the recent war between Uganda and Unyoro, the Waganda, before their defeat, demanded a very large quantity of salt (it is said 1000 packages), together with a large supply of ivory, as blackmail, to abstain from war.

Let us pay a visit to the principal centre of the salt preparation ; it lies only about ten minutes east of our anchorage. Proceeding northwards along the lake shore, one cannot help noticing the artificial landing-places made by the native fishermen for the protection of their boats, by building up walls of stones and carrying them a little distance into the lake. These walls of stone are the favourite resting-places of numbers of black-crested wagtails (*Motacilla vidua*), and occasionally a grave meditative stork (*Scopus umbretta*) also takes up his station there. A short distance further on we crossed the brook that comes from the hot springs ; its waters were dammed up so that they only reach the lake by a thin trickling stream ; the wind and waves, in fact, often pile up the sand across its mouth in such quantities as to close it up completely. From this point the lake shore trends away in a wide curve ; it is everywhere flat, and in certain places had thick patches of rushes in full bloom. Here I secured a specimen of the true western *Hyphantica erythropis*, one of the greatest rarities in our own district. The strand vegetation is extremely poor, consisting only of reeds, *Aristida*, *Calotropis*, *Datura*, and *Solanum*.

After passing the last dwelling we struck inland. Here the ground rises in a couple of terrace-like steps, the edges of which consist of clayey soil of a reddish colour, intermingled with plant detritus and some snail-shells. These terraces, therefore, are alluvial in character, the strand being now in process of formation ; the upper terrace, the edge of which lies 33 feet above the level of the lake, is, of course, the older, and the lower owes its origin to the detritus washed down from the hills and heaped up at their foot. The path led at first between groups of dirty-looking, miserable huts ; but for their unsatisfactory condition the people have some excuse, seeing that they have to purchase with salt, from beyond the

hills, the long grass of which these huts are constructed. A slight bend of the path westwards, and we stood before the salt-works.

Immediately on our left rises the lofty mountain chain, and at its foot gush forth the hot springs, to which we now descend. These springs are situated in a kind of deep ravine, ending in a corrie with perpendicular walls, formed by the incaving of the hills behind. Blocks of stone and masses of *débris*—fragments of the native rock—lie scattered about in chaotic confusion, and, under the combined effects of heat and moisture, they have assumed the appearance of wacke. The floor of the ravine, and the stones with which it is littered, are so hot that one cannot bear the hand upon them; the heat even penetrates through the shoes to the feet. On every side we heard the continuous bubbling and hissing of water; and gases gushed gurgling from the hot mud. Scores of tiny springs issue from the overheated soil, and fill the air with sulphurous gases, with which is mingled a slight smell of bitumen. The atmosphere has such a high temperature that we felt almost stifled, and as if we were in a steam-bath—and this idea was further strengthened by the little jets of steam which rose on all sides from the boiling water. This place, in which we come face to face with the workings of Nature's forces, is called by the Wanyoro, "Kabigga." The water gushes out from beneath stones, out of crevices in the rock, and immediately out of the ground. It is perfectly clear; but when mingled with the gas, it assumes a yellowish tinge. In several places its temperature varies between 185° and 195° Fahr., and it gives off a smell like that of sulphuretted hydrogen. In taste this water is slightly saline; and, when taken in any quantity, it has a slightly purgative effect. It flows strongest in calm weather, wind and rain diminishing its outgush. Earthquake shocks are pretty frequent in Kibiro. I saw no vegetation in the ravine, or at least none at its further extremity; but its upper rim was clothed with thick bushes and thorny shrubs, and between these were little clumps of an aloe, with leaves striped with white. No labour can be performed in the immediate vicinity of the springs, owing to the overheated soil and want of space. Let us therefore turn our faces lakewards, and follow the ravine towards its outlet on the west.

As we pass along we could easily imagine ourselves in the shaft of a gold mine; and, in point of fact, the salt is gold to all the people of this region. The floor of the ravine has been levelled and cleared of all stones. The hot water is conducted in all directions in small troughs, set in and cleverly supported on stones. Lumps of scoured earth lie heaped up ready for being operated upon. The several departments of work are separated from one another by rows of stones. Women and children are busy everywhere, either scratching up the saline soil, or else filling the sieve-like apparatus. The strangest thing about the scene are perhaps the walls of saline earth piled up to the height of six or seven feet, and having at their foot rows of filtering vessels; these walls, when seen from a distance, look like the ruins of a village.

The method of preparing the salt is tolerably simple. The earth from which the salt is to be extracted is placed, in the evening, under the end of a trough, whence a thin stream of water trickles over it all night long. In the morning the earth is put to dry for some hours; after this the women, with crescent-shaped pieces of iron, scratch off its superficial layers, and with them fill other small troughs, out of which they shake it again into small heaps. The next day a certain quantity of this earth is mixed with water, and then conveyed to the filtering apparatus. These consist of simple clay vessels, having holes in the bottom covered with a layer of fine hay; the vessels themselves stand upon an arrangement of three stones, and have beneath them smaller clay vessels, into which the liquid drops. When the filtration is finished, if the saltmaker is not pressed for time, he allows the liquor to evaporate in the open air; it then leaves behind it a pure white salt. If, however, time cannot be given for this process of evaporation, it is accomplished by means of boiling within the huts; but the salt so obtained is darker in colour and less pure. The skill of the women consists in mixing the earth and water in the right proportions just before the filtering begins.

Bad weather and continued rain greatly interfere with the salt manufacture, for the soil then becomes saturated with moisture, and in that state is not suitable for the extraction of salt. At such times the people break down the sides of the ravine, for they also contain a high percentage of saline matter. It is of course self-evident that this continual drain upon the layers of the ravine bottom must result in its gradually lowering. At the present time the walls have an average height of 35 to 50 feet, showing the extent to which human agency has utilised the saline deposits contained in the soil. It would be interesting to know whether the yield of salt undergoes any proportionate variation as the ravine gets deeper. For this would decide the question whether the salt, as the native workers maintain, comes from the water of the hot springs or not. I myself am inclined to think that these springs have no other connection with the supply of salt except that they open up the layers of earth in which it is contained. The salt itself must lie in the alluvial soil, just as it does at Regiaf and at Gondokoro. At all events, the people of Kibiro affirm that when the water of the springs is cooled by heavy rains, and the soil is consequently charged with moisture, they are unable to carry on the process for the extraction of the salt. But the same is true at Regiaf, where no hot springs exist. It is much more reasonable to suppose that the rain washes the salt out of the soil, and consequently the saline liquor is too thin to deposit much salt.

The salt of Kibiro is produced in granules of large size, mostly of a rather dark grey colour, which is due to the process of manufacture, and of a faintly bitter taste—a fact observed by the Negroes.

Kabrega once sent me as a present of especial value a packet of salt of a dark grey colour, but very pure in saline properties, which he obtained from Hamgurko, on the river of Ussongora (the Duéru). The bitter taste

that characterises the salt of Kibiro could easily be got rid of by a different process of evaporation and by repeated crystallisation. But the demand for it is so great that the makers cannot spend over-great pains on its preparation. The salt destined for sale is made up in cylindrical packets, and wrapped in dried banana leaves. A packet generally weighs $7\frac{1}{2}$ "ocka" (25 lbs.), and is sold for 400 cowries, equivalent in value to about 5s. 6d., for the Zanzibar Arabs in Unyoro reckon the Mejdie thaler of 20 Turkish piastres (= 3s. 5d.) to be worth 250 cowries.

In addition to salt, other media of exchange or barter are ox-hides and skins of the larger kinds of antelope, durrah and Eleusina corn, iron ore and lance points, a little brass in thick bars, and glass beads. The last-named are, however, but fancy articles, for the people mostly prefer to buy corn with their fish, eggs, and poultry, etc. Tobacco is very dear; sheep and goats are cheaper, though of the latter only the he-goats are sold; and still cheaper are poultry, which are seldom eaten in Unyoro.

The inhabitants of Kibiro are pure Wanyoro, or Bunyoro, as they also style themselves. They have a dark-tinted skin, and in shape are well-proportioned, most of them having very intelligent faces. Their clothing consists of that usually worn in Unyoro, viz., ox-hide dressed very soft. Bark-cloth, which is very dear, and therefore scarce, is worn, with goat-skins, by the women. The only weapons are lances, the blades of which are covered with leather scabbards adorned with tassels. The dialect of the people varies but little from that of Mugaia, which represents the elegant Kinyoro. The natives of Kibiro and Bugóma speak the same dialect, which bears much resemblance to Magangési. Each of the three villages which constitute Kibiro has its own chief, but the head-man of the three is Kágoro, in whose village alone salt is extracted.

The health of the district is reported to be satisfactory; just at the present moment, however, there are sporadic cases of measles, the expiring remains of a serious epidemic which carried off many victims all the way up to Wadelai. In many kinds of illness the people have recourse to bathing in the hot springs, and special cases of skin disease are brought hither from the countries beyond the hills to get the benefit of the same treatment.

Here I was agreeably surprised to receive a letter from Dr. Junker, announcing his safe arrival in Uganda; along with this came greetings from my old acquaintance Titi, formerly secretary to Mtesa, and now a frontier chief of Uganda; also an official communication from Nubar Pasha, and a very friendly letter from the Sultan of Zanzibar. I had, therefore, every reason to be pleased with the results of my expedition. I had accomplished the end for which I had undertaken it, viz., the despatch and receipt of letters by post.

Before starting on the return journey, however, I resolved to complete my labours by ascending the mountain chain on the east of the lake. Twelve minutes from my tent, diagonally across the village, brought us to the real foot of the range. At that spot the aneroid registered 706·25 (mm.)

at 23° (C.), against 707·25 at 23° near the huts (at 3.35 A.M.). The ascent led at first over blocks of stone and sharp-edged pieces of rock, and was very steep. The narrow path was, in fact, so thickly strewn with sharp fragments of rock and stone as to make our shoes a very insufficient protection for the feet. The side of the hill was quite bare; neither animals exist nor plants grow on the naked stone, which is washed clean by the rain, and baked and cracked by the fierce rays of the sun. Such was the slope up to the first terrace, where we rested in order to look about us. The steamer lay almost immediately below us, proving that we had climbed up in a straight line. The aneroid registered 699·75 at 25°. The surface of the terrace on which we stood was a long, flat ridge, almost destitute of stones, and clothed with a soft carpet of grass.

Above us lay the second terrace, which also was reached by a steep path, so that on arriving at the top we were glad to pause and recover breath. Here again the steamer lay immediately below us; the aneroid now gave 687·25 at 27°. The narrow rain gutter which had served for our path upwards from the lower terrace was in several places almost barred by diagonal crevices in the rock, which formed high and difficult steps; but worse than these were the sharp stones, which prevented us from getting a good foothold, and the thorny acacias, which made the narrow path still narrower.

Towards the summit the ascent was better, because the stones became fewer and the ground more level. At 9.24 A.M., we reached a good road, which seemed to lead on further in a south-west direction. On our left were several small dome-like summits, separated from each other by depressions, evidently forming the northern part of the range we had just ascended. The view immediately in front of us was cut off by a low summit, likewise dome-shaped. Close by us, on our right, was yet another eminence of the same character, which we proceeded to climb. We finally rested under the shade of a mean-looking *Balanites*. Here the aneroid reading at 9.40 A.M. was 680·5 at 25° (in the shade). This, without any correction, indicates that we were about 1150 feet above the level of the lake, which agrees sufficiently well with the altitude of 3000 feet assumed for the elevated plateau of the region lying between the lakes.

From the position in which we were, both the steamer and the village were out of sight; this, however, was due to the formation of the hills. The several terraces mount up one above the other like bastions, and are each crowned by a narrow flat ridge, whilst the steep channels already mentioned connect the terraces together. The view downwards is hindered by the projecting terraces and the close thickets and bushes growing on the lower slopes. Away in the west, on the other shore of the lake, the lofty hills of Lendu were wrapped in mist. Close to the edge of the hills, on our right, a narrow sandy cape ran out into the lake, bending round at its extremity on both sides like a hook. This, too, was evidently of quite recent formation, for it bore no vestige of vegetation.

All the summits of the hills are covered with *Anthistria* grass, which

serves as food for the sheep and goats when they can get nothing better. A species of scabious, with whitish blossoms and very pleasant smell, also abounds; but trees are few and low—such as some acacias with yellowish flowers, *Balanites*, *Zizyphus*, *Grewia*, and bushes of *Carissa*, with a fragrance like jasmine. In addition to these, I observed several aloes, a low *Hibiscus*, with brimstone-coloured blossoms, some low *Solanææ*, and a pretty *Polygala*. Above our heads circled a species of eagle (most likely *Aquila wahlbergii*); whilst in the bushes and on the stones we saw several examples of a species of turtle-dove and of one of pipit (*Anthus*). Here a number of people with burdens, mostly of fire-wood, on their heads, passed us on their way down.

At 9.45 A.M. we began the descent, which was quicker, but not pleasanter, than the ascent, being made in twenty-nine minutes. At 10.20 we reached our huts. Here the aneroid now read 706.25 at 29°, consequently 1 mm. less than the reading taken when we set out.

Although there was now nothing to prevent my departure, I nevertheless, at Kágoro's request, consented to stay a day longer. Towards evening that chief came with a budget of compliments and a few eggs by way of presents, excusing himself for not bringing more on the ground of bad times and short supplies—a sure means to enhance the value of his gifts. On getting the pet wish of his heart gratified—viz., the present of a pair of shoes—he took his departure in high delight. Negroes are, with a little patience and goodwill, so easy to please!

Before leaving, I took a walk to the little brook close by, going along the shore towards the south. At this part the shore is broad and sandy, with a flat margin next the water; on the landward side it rises into dunes, but falls away again beyond them. The vegetation is identical with that described above. After thirteen minutes' walking we turned away from the lake, crossed the sandy fringe obliquely, and soon reached a tract of open wooded country, the trees being mostly acacias, covered all over with the nests of the weaver-bird (*Hyphantornis abyssinica*), beside which the twittering males were keeping watch. In the neighbourhood of the brook the vegetation becomes richer and more plentiful. The brook itself, which bears the name of Katshoro, is nearly 6 feet wide, and in level places about 1½ feet deep. At the time of our visit it had inundated a large part of the land adjoining it, and fell over several pretty little cascades, or formed pools of still water resting on a sandy bottom. It issues from a mountain ravine, and all the year through has clear cold water. This alone is exclusively used for drinking by the people of Kíbiro, for they state that the waters of the lake are salt—a belief which finds credit with our Arabs here, who call the lake Bahr-el-Malach, i.e. salt-lake. The only difference is this, that the water in the lake is soft, and always a little warm.

On my way back, I noticed in the tall grass a great number of cylindrical fungi, about 0.13 to 0.16 inch high and .016 inch in diameter. The crown consisted of a small brown closely-set cap, often punctured with holes;

the stalk was smooth and pale yellow in colour. The whole of the frame was shiny, and gave out the odour of rotten fungus. From the troughs in the saltworks I captured some specimens of the pretty little *Egialites pecuarius* (plover), which frequents them in numbers, and on the lake-side a beautiful *Buteo augur*, var. *nigra*, which was busy catching mice—both birds being novelties in our district. I also procured some specimens of a tick, called by the Wanyoro *bilbo*, which are greatly dreaded by the Negroes, and, to judge from the size of the creature, their fear is not ill-grounded. Against its attacks they employ a curious remedy; a scale of the pangolin (*Manis* sp.), calcined and pulverised, is mixed into a salve with fat, and the preparation is then applied superficially. *Ocymum canum* is also useful for the same purpose.

By noon we had all our baggage on board and steam up, and with a strong south-west wind, which whipped the lake into short white waves, we started on our return journey. The steamer was full of sheep and goats. Every one of my people had been eager to purchase these animals, as well as salt and tobacco; and in order to encourage them in this commerce, I had given them some ox-hides and a quantity of cowries. We soon left the villages of Kibiro behind us, steering parallel to the uninhabited foreshore towards the north, where the hills appeared to be quite as lofty and quite as steep as at Kibiro. The western shore was again enveloped in mist.

Our little boat rode gaily over the waves, but when we got about a mile and a quarter out into the lake she began to roll so much that the majority of my people were again helpless with sea-sickness. About one o'clock the hills on the west began to peep through the mist. Our course was almost a straight line towards the north-north-east, but the strong cross wind kept us back somewhat. Towards three o'clock we came in sight of the island of Tunguru, but we kept to the open lake, and could now distinguish the east shore again, as well as the chain of hills that falls away towards Massindi. Throughout this course, and also off Kibiro, we saw no traces of *Pistia* rosettes either on the shore or on the lake, whereas the whole of the west side is full of them. At four o'clock we passed the island. Gradually approaching the west shore, we steamed past the wood off which we had spent the stormy night on the outward journey, and where we now saw large fires burning, which gave us a fine evening illumination of both land and lake. About 5.32 P.M. we once more cast anchor before Boki's village of Tanjimoro. The way home to Wadelai was the same as that by which we came out.

APPENDIX.

APPENDIX.

The following are extracts, bearing on the above Paper, taken from a letter received by Dr. Robert W. Felkin, on 9th May, from Emin Pasha:—

“In one of your former letters, you ask me to send one of my papers to be published in England, so I send you the enclosed, which you can publish where you like. It is an account of a tour to the Albert Nyanza, which I made on purpose for you. You must excuse the many faults in it, but the circumstances under which it was composed will, I hope, be sufficient excuse for its shortcomings. Since I wrote it, I have made two other excursions to the lake, and have gathered a considerable amount of fresh details. I might, perhaps, send at once the detailed map which I have drawn up, but as there are several points which I should like to clear up more fully, I will wait a while, and only give you, in the meantime, the chief results of my work. . . . This is the discovery of a new river which flows from the Ussongora Mountains. It is of considerable size, and flows into the lake at the south. The river, which is called Kakibbi by the Wasongora, and Duéru by the Wamboga, has, near its junction with the lake, a large island. It is, however, on account of the many cataracts, very difficult to navigate, but, on the other hand, it pours into the lake throughout the whole year a large volume of water. Upon its banks, at a short distance from the lake, is the town of Hamgurko, where a considerable quantity of salt of a superior quality is found. The Kakibbi or Duéru forms the boundary between the Muénga district of Unyoro, which lies to the east, and the country of Mboga, which lies to the west. The country of Mboga is inhabited by a people who speak a language that appears to be only a dialect of the Kinyoro. To the W.N.W. and N., Mboga is bounded by Lendu, a country which lies behind the mountains bordering on the Albert Lake. To the west, I found a country inhabited by tribes I take to be Iddio (A-Sandeh). To the S.W. I was told there was a large river, on the banks of which there is a colony of Akkas—called Balia by the Wanyoro people. They, however, call themselves, in their own language, Betua. I could here give you a considerable amount of information concerning the light-coloured Wahuma, from Mruli and the Toru Mountains, and about the Wakonjo, etc., but, for the present, what I have said must suffice. As soon as I have another opportunity, I will send you full particulars on these subjects.

“The zoological, and especially the zoo-geographical, results which I have obtained during the last few months will, I hope, be of considerable importance. I am sorry, however, that I have not the necessary textbooks to help me to work out in detail all I have found.

“By the same post I send to Professor Ratzel two papers for publication, and I have already sent to Gotha a complete map of my last Monbuttu journey, which will go to complete some of Junker's work. I have sent by the same opportunity one or two cases of preparations to England.”

BECHUANALAND, WITH SOME REMARKS ON MASHONALAND AND MATEBELELAND.

(Read at Meeting of Society, 24th, March 1887.)

BY JOHN MACKENZIE, LATE DEPUTY-COMMISSIONER OF BECHUANALAND.

BEFORE I went out to South Africa in 1858, a Scottish gentleman was good enough to offer to supply me with the necessary instruments to enable me to do the work of an explorer as well as missionary. While deeply grateful for so liberal an offer, I felt it was my duty to decline it, replying that, as I then hoped to be associated in mission work with the greatest of explorers—Livingstone—I had no intention of directing my attention to work which was so admirably performed by him. Were this platform occupied only by explorers of unknown regions, I should, of course, have no right to address you; but I have deferred to the kind opinion of your Executive, that I might be able to add somewhat to your knowledge of certain parts of South Africa with which I am well acquainted, and which are destined soon to occupy a great deal of public attention; while you will also expect me to make a few observations on that most interesting and important subject which I have “explored” and studied for many years—the meeting of the two waves of population in South Africa—the European and the native, and the orderly opening up and development of the country, so that the one race shall be the helper and friend of the other.

The earliest communication between North Bechuanaland and the outside world would seem to have been with the East Coast. The chief Sekhome was always pleased to inform me that he had had possession of white men’s things before missionaries and traders reached him from the South. I found that his early contact with European civilisation had been very limited indeed, and consisted in the present of an umbrella and a small earthenware basin!—which certain native priests or rain-makers from the East had procured from the coast, and brought with them to Shoshong as rare presents for an inland chief. These strangers from the East brought also with them a quaint name for the sea, for which in some Bantu dialects there is no appellation, inasmuch as while they know fountains, springs, wells, pools, lakes, and rivers, they do not know the ocean, and had no name for it. Travellers from the east, in order to establish their reputation as having seen many strange things, used to state that they had been as far as Metse-hula—that is, the water which goes out to graze: the water whose tides reminded them of the cattle in their native town—going out to graze in the morning, and returning again in the afternoon.

But while the natives in North Bechuanaland were never visited by the white men from the sea-coast, we learn that as early as 1801 General

Dundas, who was then "Acting Governor and Commander-in-Chief of the castle, town, and settlement of the Cape of Good Hope," sent Messrs. Truter and Somerville as Commissioners to explore the country to the north of the colony, and supplied them with articles for the barter of cattle from the natives.¹ The party, besides the two Commissioners, consisted of a draughtsman, secretary, superintendent of wagons, 7 Dutch Boers, 24 Hottentots and half-castes, and 4 slaves. They had 120 draught oxen, 18 saddle-horses, and 20 large muskets. Thus accoutred, this exploring expedition started for the north. That which struck the travellers most in passing through what is now the Cape Colony, before they reached the Orange River, was the extraordinary sterility of the country. That dreary region, however, by the labour of man in the opening of fountains and the construction of reservoirs or dams, is now a valuable part of the colony, and supports many thousands of sheep. At the time of which I am speaking the wool industry had yet to be begun in South Africa. The sheep which the English found the Dutch colonists possessing was that species which has hair, not wool, on its back, and which is found throughout Africa and Asia also. Crossing the Orange River between 23° and 24° east longitude, our travellers, proceeding northward, found themselves at Kuruman Fountain, afterwards the site of the well-known mission station. Some 36 miles further on, they came to the large native town of Litako (or Takong)—the Lattakoo of some after-writers. Let us hear the first impressions of these two Government Commissioners on finding themselves in a large Bechuana town:—

"The sight of so great an assemblage of human habitations after so long and dreary a journey was equally as unexpected as it was agreeable. In a country so desolate as Southern Africa, where so few human beings are met with, and these few in the last stage of misery, the pleasure must be doubly felt of encountering a large society of mankind whose condition has the appearance of something like comfort. The venerable chief Molehabangwe was sitting in the midst of his Council, in a circular space surrounded with wooden palings. He received the Commissioners without the least embarrassment, and in the most friendly manner. The women examined their hair with the closest scrutiny, scarcely being able to persuade themselves that it was of natural growth, but supposing it rather to be the tail of some animal fixed close to the head.

"The town of Lattakoo was estimated to be fully as large as Cape Town, including all the gardens of Table Valley, and to contain from ten to fifteen thousand people.

"The women brought milk in leather bags, in wooden bowls, and in earthen pots, sufficient for the use of the whole expedition. As the night approached, the people gradually left the encampment, and the travellers retired to rest with as much composure, and as free from any anxiety as to their personal safety, as when in the midst of the deserts, to which they had so long been accustomed in the south.

¹ An account of this journey is to be found in the form of an appendix to a work by Sir John Barrow on Cochin-China, which was published in London in 1806.

"The dwelling of a Booshuana is not ill calculated for the climate. In elegance and solidity it may probably be quite as good as the *casæ* or first houses that were built in Imperial Rome, and may be considered in every respect superior in its construction and in comfort to most Irish cabins.

" . . . But the Booshuanas are arrived at that stage of civilisation which is not satisfied with the mere necessities of life supplied to them abundantly from the three sources of agriculture, grazing, and hunting.

" . . . The Booshuanas may in every respect be considered to have passed the boundary which divides the savage from the civilised state of society, and to have arrived at that stage of moral refinement which is not incompetent to the reception of the sublime yet simple precepts of the Christian religion. It is here the missionary might employ his zeal to some advantage—here a plentiful harvest is offered to the first reapers who may present themselves. They seem to have stepped beyond the Kaffirs in the arts of civilised life."

Such was the favourable impression produced by the Bechuana on the minds of those who first described them to the outside world. It is amusing, however, to be told that when the Commissioners proposed to visit the Barolong clan to the north, in order to barter more cattle, the "venerable Molehabangwe" met their proposal, as every chief has done for ages in every part of Africa, by a refusal to consent to their going beyond his territory. This was professedly in their own interests. The chief further inland was a bad man, and Molehabangwe did not wish to have the blame among the white men of their misfortunes or their death—the real reason all the while being tribal jealousy.

Lichtenstein and Burchell followed one another rapidly in the description of part of Bechuanaland; and the well-known missionary traveller John Campbell performed two journeys to Lattakoo, as he called it, on the second of which he was accompanied by young Robert and Mary Moffat, whose great work has since ended, and been recorded by their youngest son and daughter in an interesting book, which many of you may have read. When I mention the name of Campbell and his books about Lattakoo, I am dealing with facts in the early history of Bechuanaland, but of comparatively recent history so far as the lives of men are concerned. If I am not mistaken, I am honoured by the presence here to-night of a gentleman who has heard Campbell himself describe Lattakoo, and who has had both Moffat and Livingstone as his guests in this city. Campbell was a man of one idea. When he saw a beautiful African fountain purling among its pebbles, he did not view the situation with a soldier's eye, considering how it might be defended, nor with a farmer's calculations as to the profits on capital expended on the improvement of the land. It is said that on all such occasions, Mr. Campbell had only one exclamation—"What a fine mission-station this would make!"

Dr. Andrew Smith, the naturalist, explored as far as the present Transvaal in 1835, and has left a carefully illustrated record of his researches. In 1839, Mr. George Thompson, a Cape merchant, published an account of his visit to Kuruman and its neighbourhood, at the exciting time when hordes of savages were hovering in uncertainty in its neigh-

bourhood—undecided as to their future line of march. The Griquas, under Waterboer, have the merit of driving back this host of Basuto, who not only threatened Kuruman, but were bent on invading the Colony from the north. This host, then called the Mantatees, turned their steps northward, and were afterwards known to the world as the Makololo—the friends and companions of Livingstone in his great journey across the African Continent. Soon after Thompson's work was published, there appeared the better-known work by Robert Moffat—a book which we all read in our youth. When he returned to South Africa in 1842, Dr. Moffat took with him the Bechuana New Testament and Psalms, bound in one volume—a precious book to introduce to a country.

Dr. Livingstone, Mr. Edwards, and Mr. Inglis opened up pioneer mission stations far to the north of Kuruman; and the people of Shoshong often described to me the appearance of the doctor among them, about 1845, on ox-back—the first missionary they had ever seen. These mission-stations were broken up by the Transvaal Boers; and this action of theirs—so at variance with their own highest religious views and best feelings—was the means by which the efforts of the localised evangelist were to be exchanged for those of the Christian explorer.

Then, in 1857, came the first work of Dr. Livingstone, a man who was not deterred at one native town by the sinister stories told him concerning the chiefs further on, and whose track across and over Africa was nevertheless entirely devoid of blood-stain. Livingstone was always an evangelist, a bearer of Christ's Gospel; but he was also the messenger from one part of the human family to the other. He made Europeans and Africans known to one another, and explained the benefits to be derived by closer intercourse.

Three Years in South Africa was published in German by Dr. Fritsch, an accomplished German traveller, who visited North Bechuanaland in 1864. Thomas Baines and James Chapman published interesting works, dealing with South-West Africa and the region of North Bechuanaland, as far as the Zambesi Falls and Matebeleland.

Another German traveller, Mohr, described, in 1876, his travels as far as the Zambesi. In 1871, in a little book called *Ten Years North of the Orange River*, I attempted to describe the every-day life and work of that region, taking pains to explain the ethnology and the polity of native races, as well as the progress of Christian work. The Rev. T. M. Thomas described Matebeleland, having resided there for many years as a missionary; and Mr. Charles Oates is the editor of an interesting book, containing the journals and letters of his brother, Mr. Frank Oates, a young naturalist, who died from malarial fever caught in the neighbourhood of the Victoria Falls.

Dr. Holub, in 1881, published in English—what had already appeared in German and Bohemian—an account of his painstaking work as a naturalist and explorer in Bechuanaland.

A posthumous work of Thomas Baines, more recently published, and

called *The Gold Regions of South-East Africa*, contains an interesting, although inadequate, account of the traces of an ancient gold-mining industry in the region lying between the Limpopo and the Zambesi. Mr. Farini has the merit of minutely describing the Kalahari region and the Falls of the Orange River. In this connection I may mention a book, *King Solomon's Mines*, which may possibly have been read by some who have not perused others I have mentioned. In giving this list of authorities on Bechuanaland and neighbouring regions, I must not omit the works of Roualeyn Gordon Cumming, of Anderssen, of Baldwin, of Selous, and of Parker Gillmore, all of whom were attracted by the large game of South Africa. To this list I ought to add certain Blue-books, beginning about 1878, when Bechuanaland first came into close contact with British authorities, and extending to the present time, when part of Bechuanaland is a British Colony.

An account of the enterprising journey of Mr. Kerr from Matebeleland to Lake Nyassa, pluckily performed under serious drawbacks, has been recently published. There remains still unexplored the single district between the Zambesi and Lake Bangweolo, where Livingstone died. The indefatigable Austrian traveller, Dr. Holub, whom I have much pleasure in reckoning among my friends, has recently met with opposition from a warlike tribe, and has been driven back, on this route, with the loss of the life of one of his companions, and has had to abandon his wagons and specimens. Whilst sorry for this reverse, we are all glad that the lives of Dr. and Mrs. Holub have been spared, and I cannot but express the confident hope that the Austrian Government will adequately support this distinguished traveller, whose disinterested work in Africa is calculated to cast lustre on his country.

I cannot hope to tell you much in the time at my disposal to-night; but I have at least guided you to a variety of sources from which you can learn more. It is time, however, that we approach for ourselves that interesting country about which so much has already been written.

BECHUANALAND.

The Bechuanaland of the Bechuana is bounded on the north by the Zambesi; on the south by the Cape Colony; on the east by the Transvaal and the Matebele; and on the west by the limits of their hunting grounds in the Kalahari Desert. The first Bechuanaland protectorate was restricted in the first instance, in 1884, to a limited district near the Transvaal. Treaties made with chiefs further west were disallowed. This was a notable instance of the "cold stage" succeeding a period of warmer interest. But any protectorate was unwelcome to Germany, who had recently obtained a footing at Angra Pequena, on the West Coast. If Germany had quelled the disturbances in Bechuanaland, which we had allowed to go on for years, the great Chancellor would have established a good right to occupy the country, and shut in our commerce on the north of the Colony.

But in this case we were in advance of Germany. Like a wedge, our protectorate ran northward from the border of the Cape Colony, and precluded the idea of another power entering from the west and consolidating a dominion from ocean to ocean, which might eventually have included the Transvaal. When it was demanded at Berlin what our real object was in Bechuanaland, and how far our protectorate extended, there could be no further indefiniteness, and so those who objected to a treaty with the chief at Morokweng, as being too far west, agreed to be responsible for him and for the country hundreds of miles to the west of him as far as the 20th degree of east longitude. The northern boundary of our protectorate announced at Berlin was the 22d degree of south latitude. It included Shoshong and some country to the north of it, and it extended indefinitely eastward over the almost uninhabited country due north of the Transvaal. The sovereignty of the Queen, however, has been proclaimed over only a portion of this territory, which may be said to be bounded by the Molopo River. Bechuanaland is thus partly a colony, partly a protectorate, and partly native territory—an exemplification of that wretched indecision which has been our bane in South Africa, and the cause of so much expense.

North Bechuanaland is in many parts well wooded and beautiful, its hills covered with vegetation to their summits. This is a country which is capable of sustaining a large population, when the appliances of civilisation have been introduced; but it is at present very sparsely inhabited. The Kalahari Desert is no desert in the usual sense of the word, as you will understand at once when I mention that it is largely covered with heavy forest trees, whose roots must be supplied with the necessary moisture. Like many a district of Australia, the greater part of the Kalahari, as we find it to-day, is perfectly useless to the European. But, like those Australian districts, the Kalahari, with well-sinking and fencing, would become an unsurpassed region for rearing cattle, sheep, and Angora goats. Even the impoverished natives whose hard lot had driven them to seek the shelter of the Kalahari, have possessed numerous herds of cattle, sheep, and goats. In the dry months these animals congregate where wells have been dug, or where there is a fountain. After the rains have fallen, and the wild water-melon has grown, the stock no more think of water; they eat the melons instead, and their owners can thus drive them for summer grazing to districts at a distance.

A large Australian stock-farmer was lately asked in my hearing, in London, what news he had from his manager and overseer. He was a Scotsman, and replied, characteristically, that "the news was good, and yet bad": the stock had increased so that there was neither pasturage nor water enough for them. "And what are you going to do?" he was asked: "Only sink a few more wells and run up some more wire-fencing—that is all." You would hardly credit it, but I can assure you it is true, that this energetic way of meeting difficulties has been too little practised in South Africa. There is as yet very little fencing; hardly any sheep

spend the night in an enclosed grazing-field in South Africa, except in some parts of the Eastern Province; usually all are brought home to pens, where they are housed during the night, thus treading down and destroying the pasturage every night and morning for some distance round the farm steading. With the energy and quiet determination of my Australian friend, there is no doubt that we should have in Bechuanaland and other parts of South Africa, an Australia thousands of miles nearer England and Europe than the one at the Antipodes.

South Bechuanaland is an open grassy country, having much in common with the Transvaal, the Free State, and the eastern part of the Cape Colony, and is far superior in appearance and in actual natural value to the North-Western Province of the Colony from the Karroo northward. The acacia trees which are found at the foot of the hills, and other sheltered parts of the country, would have been more abundant but for the cold in severe winters. I remember seeing a large tract of fine acacias in South Bechuanaland killed by the frost of the severe winter of 1875. Then, the districts near Kimberley have been well-nigh denuded of trees in order to supply fuel for the engines at work at the diamond mines. But this destructive work has been rendered less necessary and less remunerative since the opening of the railway to Kimberley in 1885, as coal now competes with firewood. The wild olive, the karee, and the wilgerhout are found in the plains and by the river banks of South Bechuanaland, while the mahatla and the moretwa bushes give variety to the landscape, and afford grateful shelter to the stock in the cold weather. The Bechuanaland landscape during the dry winter months bears a solemn grey aspect, from the colour of the ripened prairie grass, but a few days after the first rainfall a glorious change takes place, as if by magic. Grey gives place to green, and Nature with lavish hand scatters everywhere brilliant flowers, to beautify a scene which in many cases is almost tenantless by man. During the summer months the rainfall is great. The old saying is strictly true there: "It never rains but it pours." I must add, however, that it frequently threatens to rain without doing it. You see the storm in the distance—you hear the growling of the thunder. On it comes, a blinding storm of dust, warranted not only to enter your nicely-dusted parlours, but your own eyes and mouth, and ears and nostrils. The thunder is now at its loudest, the lightning literally blinds and dazzles you; and sometimes all this is only "threatening," and there is no rain. After such a paroxysm the copious tears of Nature are welcome indeed. If it does not rain, every one is disappointed. We speak of "a fine rain" out there—"het lieve regen," say the Dutch-speaking colonists—while in this country you say, with an heroic effort at resignation, "another rainy day." What has to be done in Bechuanaland and in South Africa is to conserve the rain which falls, and which makes haste to escape to the ocean.

The district round Kuruman is not equal to some other parts of Bechuanaland for grazing purposes. Like some parts of America, it is so

cold, and the natural grasses deteriorate so greatly in winter, that without artificial feeding breeding-stock do not thrive well. But with a little help in the way of fodder of some kind, the stock pull through the cold weather.

Bechuanaland produces iron, copper, and gold. The last-mentioned metal was thought of no more value by the natives than copper. When I showed the chief Sekhome the gold as it was seen in the quartz, he at once recognised it as having been used in making those armlets which are so much liked by native women, and which I observe have been recently introduced into this country—an African contribution to fashion. But while iron was smelted in charcoal furnaces and made into hoes, adzes, axes, and spears, knives, razors, and awls, or needles, the Bushmen in distant parts of the Kalahari were still in the stone age, using flint axes and arrow-heads, as the New Guinea people are doing to-day.

Bechuanaland is, however, first of all, a grazing country, suitable for cattle ranches. Till recently it was overrun with game, and besides these immense troops living on its grasses, when Europeans first visited the country they found the people in possession of large herds of long-horned cattle. In the late disturbances, it has been said that Mankoroane and his people lost some 40,000 head of cattle, besides flocks of sheep and goats. But the natives were agriculturists as well as the owners of flocks and herds. Every man has still his patch of ground; among the more industrious tribes every child has its field of millet and sweet cane, so that from its earliest years the boy or girl is stimulated to personal exertion and to the holding of personal property. Without irrigation the natives grew several kinds of millet (*sorghum*), a grain which is known extensively in Asia, as well as throughout Africa, as the staff of life. Pumpkins, water-melons, calabash plants, beans, vetches, ground-nuts, with several kinds of sweet-reed (an inferior sugar-cane), were all grown by the Bechuana from time immemorial. Maize (or mealies, as it is called in South Africa) is of recent introduction, and, like the umbrella and the basin, came from the East Coast. It is less hardy than the millet, but crops can be raised without irrigation. Irrigation was practised by the natives only in raising dagga (the "bang" of India), the wild hemp, which many are fond of smoking. Tobacco, like maize, was introduced more recently, and is successfully grown throughout Bechuanaland and South Africa. The natives used it chiefly as snuff—one of the ordinary salutations in North Bechuanaland having reference to this custom. With irrigation the soil and climate of Bechuanaland are very productive, growing fine wheat in winter, and a crop of maize on the same ground within the year. I have in my mind's eye a garden which contains apples, pears, plums, peaches, apricots, nectarines, Seville and Mandarin oranges, two kinds of figs, lemons, loquats, quinces, pomegranates, grapes, almonds, and walnuts. Of course a garden of this kind is not raised in a wilderness in a day; it is the work of skill and industry during years; but what I want to show is, that where you have water for

irrigation your labour and skill will be seconded by a beautiful and fructifying climate.

Indeed, the climate of Bechuanaland is one of the finest in the world. The country is between 3000 and 5000 feet above the sea-level. We have cold weather in winter, and ice on the pools as far north as Shoshong. But we have no cold and damp combined; our rain-fall is in summer, modifying our hot weather by the delightful coolness which succeeds a fall of welcome rain. Between May and September we do not expect any rain—hardly any cloudy weather—day after day of perfect loveliness. I remember asking an officer in the late Bechuanaland Expedition—"Could you make any suggestion as to the weather to-day in the way of improvement?" and, after thinking a little and considering the possibility of a growl or grumble, he admitted he had no suggestion to make! We have great heat at mid-day, but the earth is cooled down every night. Many afflicted with pulmonary weakness have prolonged their lives by going to South Africa; while others have been completely cured, becoming robust and strong. Others, however, finding employment on the sea-coast, or in some inland town not sufficiently removed from the sea-board, derive only temporary benefit. But it is unfair to say that the climate has done them no good, inasmuch as they have never tried it; for the climate which can really benefit such cases is not to be found anywhere on the coast, or within the coast-belt which is affected by the sea-moisture.

Of course, there are diseases even in a healthy country; but, so far as my observation goes, the Bechuana live to a great age, and compare favourably, as to physical vigour, with Europeans of their own age. In the regions of the Zouga River and Lake Ngami or Nghabi, as also in the Zambesi region, we have, every spring and autumn, malarial fever. Natives from the high-lying parts of Bechuanaland seem to be as liable to this climatic fever as Europeans. When promptly met by suitable remedies, no disease would seem to be more amenable to medicine; and, even in cases where it has taken a firm hold of a person, and assumed the form of a weakening ague, change of air and the free life of the wagon journey have been known to effect a complete cure without a visit to Europe. In a dry season, when the early rains have been long delayed, dysentery sometimes appears—especially in years of scarcity among the people. Ophthalmia is known everywhere in Africa, and therefore in Bechuanaland. Those who are liable to this most painful disease in South Africa are quite free from it in this country. Whilst it is very painful during the attack, it is also a malady which is amenable to treatment; and I have not known a case, in which care and attention have been exercised, where any real damage has been done to the vision, though such damage often happens where ophthalmia is not attended to. Small-pox and measles have usually appeared together—passing through the country, and then being entirely unknown for years, till fresh contagion once more travels from the sea-coast. It was the

native custom to inoculate as our forefathers did before the time of Dr. Jenner. The arm is, with us, the usual place ; the natives inoculated also on the leg just above the knee, and on the forehead. In 1863 small-pox appeared at Shoshong before I could get lymph for vaccination. I therefore practised inoculation—selecting virus from children in whom the disease was well developed, and who were, nevertheless, able to walk about. I was not told of more than one case of those whom I inoculated being confined to bed. The disease itself was most destructive of life at Shoshong, and throughout South Africa—chiefly, I am afraid, through absence of sufficient attention and nursing.

I may mention that insanity is known in Bechuanaland, although it is not common. To be insane is to be “entered,” in the Bechuana language,—an expression akin to our word “possessed.” It is believed that the person has then more than human thoughts to guide him ; and I have known Bechuana take with them presents, and gravely consult an insane person on the thousand and one questions on which human nature would like to be informed in Bechuanaland and in Britain. The natives, of course, had no asylum and no jail. If, then, an insane person became dangerous, and threatened or took life, a sharp spear soon ended the career of one who, a few days or hours before, had been gravely consulted about public and domestic affairs.

A few words now as to the ethnological side of our subject. There are two great families of natives in Southern Africa. The first is the Gariepian or Yellow people, including Hottentots, Namaquas, Korannas, and Bushmen. This family is not numerous ; it inhabited the south and south-west part of the continent. In the oblique eyes ; in the fact that, as in Chinese, there are notes or tones by which the same word can be changed in its meaning ; in the custom of these people that the cow-milking is handed over to the daughters and not to the sons of the family ; in the languages, which are suffix-languages and also sex-denoting, we find nothing in common with the other family, which has been termed the Bantu family. The Bantu are darker than the Gariepian, but are not black. This family includes all the other tribes in South Africa up to and beyond the Equator, and to it the Bechuana belong. Their language denotes the plural by a change of prefix, or addition to it, with no change of affix ; and in this way connects the people with the South Sea Islanders more than with the Gariepian people who are their next-door neighbours. Instead of “daughter” meaning the milkmaid of the family, no woman may enter the cattle-pen of the Bantu tribes—much less milk the cows, as do the girls of the yellow tribes. The Bantu languages are not sex-denoting ; the nouns are divided into a certain number of classes, each of which has its own prefix and its corresponding article running through a sentence, reminding one of the use of the article in Greek. The language of the Bechuana and of the Basuto is one and the same—while Kaffir and Zulu are as far removed from it as German or Dutch would be from English. Relatively little attention

has been paid, as yet, to the South African languages by comparative philologists. The late Dr. Bleek made a fair beginning; and the Rev. F. W. Kolbe is giving great attention to this most interesting and important subject. The latter gentleman holds the opinion that the Bantu languages are as old if not older than Sanskrit, and states his belief that points which are unexplained satisfactorily to comparative philologists by Sanskrit, find an explanation in the Bantu.¹

The religious views and observances of the Bechuana would favour this opinion rather than oppose it. The Bechuana are ancestor-worshippers; there is a sacred dance at each new moon; their year is divided by a succession of ceremonies of a religious nature; once a year there is, or ought to be, the introduction of sacred fire from the priests for the use of the people; they have simple rites at seed-time and harvest; they are believers in amulets and charms or fetiches, which in North Bechuanaland develop into what is called an idol,—that is, a fetich too large to be carried about on the person, and which has a place devoted to it in the enclosure of a priest or sorcerer. Worship in a dense grove, on high places, sacrifice at the tomb of an ancestor, shaving the head in certain ways, wearing old garments when in mourning, putting ashes over the eyes at the time of burying the dead,—these, and many other observances of the Bechuana, carry the astonished European back through many centuries, to the time when the patriarchs lived and tended their flocks. As a young man studying to be a native minister remarked to me, when reading about the customs of the neighbouring Canaanitish nations which the children of Israel were warned against, “Our people must surely, at

¹ I am not qualified to pass an opinion on this subject; but I can testify to the copiousness, symmetrical and philosophic arrangement, and absolute beauty, of the language of the Bechuana and the Basuto. It has no click like the Zulu, or Kaffir, or Gariepian languages. There is nothing abrupt in the language—a word always ends in a vowel or in the ringing *ng*, as *tsophe* (*tsibi* of the Hebrew), a spring-buck or gazelle; *logong*, a piece of wood. A few words will give you some notion of the nature of the language, and the way in which the plurals are formed.

SINGULAR.

Monona, *man*.
Mosadi, *woman*.
Pheho, *wind*.
Moea, *breath, spirit*.
Lohaha, *a feather*.
Letsatse, *sun, day*.
Ngwedi or Khwedi, *moon*.
Naledi, *star*.

PLURAL.

Banona, *men*.
Basadi, *women*.
Dipheho, *winds*.
Meoea, *spirits*.
Diphaha, *feathers*.
Malatsi, *suns, days*.
Dikhwedi, *moons, months*.
Dinaledi, *stars*.

Logadima, *lightning*; mapotopoto, *waterfalls*; ngongorego, *grumbling*; loshu, *death*; lesedi, *light*; lehihi, *darkness*, are all expressive words. A few forms of the verb may be given:—Diba, to work; dihele, to work *for*, or serve; dihisia to *cause* to work; itiha, to work *oneself*; itihela, to work *for oneself*; modihhi, he who works—a worker; modihedi, *he who works for another*—a servant; moitihedi, he who serves himself.

A sentence is thus constructed:—Batho ba tsile: People have come. Batho ha ba baintle ha tsile: People who are beautiful have come. Batho ha ba baintle ba tsile; ba romilwe ke kgosi ea bona; ba tla bulela kamosho: Beautiful people have come; they have been sent by their chief; they will tell their news to-morrow.

some time, have been in those regions, for these are the customs which they still practise."

You would hardly be prepared to be told that we have among the Bantu people in South Africa examples of the various modes of government which have obtained in Europe; but such is the case. There is, first and simplest, the patriarchal form, in which each head of a family is the equal of his neighbour, and there is no general government. This form obtained among the Damara, the Mashona, and the Makalaka, the last two being the most industrious and most advanced tribes as to skill in handicraft; only they have been broken up, and almost destroyed by the attacks of more warlike tribes. Next we have the limited chieftainship—that is to say, the head-men have over them and the tribe a head or chief who has greater power than any one of them, but who cannot act alone either in making war or peace, but must be guided by the advice of his "younger brothers" or head-men. The Bechuana and Basuto are illustrations of this mode of government. The business of the tribe is really transacted by the chief and his head-men; but it is customary to assemble a *pitsho*, or general council of the tribe, when the programme of the chief and head-men is brought forward, advocated, and usually, though not always, carried through. These tribes were industrial and commercial rather than warlike, but had cohesion enough to act in self-defence. Cattle-lifting was the great object of their wars, when they did take place, and their skill in everything connected with such an operation was very remarkable. The head-men, and commoners also, usually had property in stock; every one had his garden, and each division of a town had its own hunting-field.

We come next to the warlike tribes, who, in Africa as elsewhere, live under a despotic or one-man form of government. The Zulus and Kaffirs were instances of this mode of government; the Matebele Zulus, under Lobingula, the son of Moselekatse, still retain this form, although in Matebeleland it has been greatly modified by the teaching of Christianity, and by constant commercial dealings with English traders. Some years ago the commoner among the Zulus was simply a soldier. He had little or no property except his weapons, and if he were ever permitted to marry, it would be after years of soldier life, and as the reward of his actions in the field. The Zulu town consisted of a row or rows of huts round an immense cattle-pen. The cattle in the pen were the chief's; the huts surrounding the pen were occupied by his soldiers, who were there to defend them. The whole country was one citadel, every military town being within easy distance of others on every side, while outside the country there was a devastated unpeopled region like the bare open space on each side of a well-placed fortress. When the stranger touched the Matebele country, after crossing the unoccupied territory, he was at once announced at headquarters, and he could not move a step forward without permission from the chief. I have never read of cruelty exceeding that of those warlike tribes living under despotic chiefs. They spared

neither old men nor old women when a town was at their mercy. The girls and boys they took as captives, their little brothers and sisters who could not walk along with them were remorselessly put to death. As a soldier said to me, "They would only have been devoured by the wolves if we had not killed them."

In a war between Bechuana chiefs, the women in the olden time did not leave the town. Fighting then only with the spear and battle-axe, the men alone were attacked, and there was no danger in those days from stray bullets; but when the Zulus or Matebele were expected to attack a Bechuana town, all women and children were hurried off to inaccessible caves in the mountains known only to the Bechuana, and the men of the tribe remained down below to defend themselves as best they could from their ruthless enemies.

A survey of South African modes of government, therefore, shows us that the one-man government is confined to warlike tribes, who practise little tribal industry, whose gardens even are usually cultivated by slaves, and who are constantly at war with the neighbouring tribes. At the other extreme we have the advanced Mashona and the industrious Makalaka smelting their iron, growing their rice, millet, maize, and cotton—weaving the latter into blankets and shoulder-cloths; but possessed of no tribal cohesion—one man as good as another, and therefore all practically at the mercy of a warlike enemy. Between these extremes we have the tribes with limited chieftainship, with more cohesion than the Mashona, on one hand, and a curb on the chieftainship, to prevent it from becoming despotism, as among the Matebele, on the other hand. As a matter of fact, the public business of Basutoland or Bechuanaland has been conducted by chief and people from time immemorial; and Dr. Livingstone has recorded his appreciation of their ability in public speaking, as well as in managing their public affairs. Of course, the chief of a warlike tribe is proud of his position and his power. "The Bechuana," said Lobingula, the son of Moselekatse, to me, "are like little birds on the branches of trees; and their chief is only one of the birds. One says, 'cheep,' and the other answers, 'cheep,' but where is the masterhood? Here," holding up a single finger, he added, "in this country there is only one voice heard; it is for all others to listen and obey." Perhaps in the distant future the kings of men, of whom we are told that we ought to discover them and place them over us, will also be princes of peace, and true fathers of their people. At present our survey of the groping efforts of South Africans in the art of government teaches us that men cannot live in this world at present unless they are able to defend themselves in it; and that when a nation is united and powerful, and under a despot, it is almost sure to go to war with a neighbour who has less warlike organisation. Able to defend—yet not constituted to attack—the happy medium would seem to be reached in these communities where the supreme power is tempered by the advice of the great in the land, and also by the voice of the common people freely spoken. Such would seem to be

the lesson to be derived from the primitive, and yet entirely dissimilar, methods of government which we have briefly reviewed.

MATEBELELAND.

The Matebele broke away from the iron rule of Chaka, the great chief of the Zulus, and, led by Moselekatse, moved northwards, first into the southern part of what is now the Transvaal. Afterwards they proceeded further northward, not entering what we now call Bechuanaland, but occupying the central part of the Transvaal, from which they drove out the previous native Bechuana and Basuto occupants. The Matebele were altogether about ten years in occupation of part of the Transvaal country, when they themselves were compelled to flee, after having been attacked by Korannas and half-castes under Jan Bloem, and by certain Dutch-speaking farmers or Boers, who were looking out for a new country, and who, it must be remembered, had been first attacked by the Matebele as they approached their country. But what caused the flight of Moselekatse northward was the appearance on his track of a large army of Zulus, from whose sway he and his people were deserters. A bloody and decisive engagement was fought, the result of which was that the Matebele carried their short spears and their ruthless habits northwards again, and made a country, then occupied by industrious and peaceful tribes, the wilderness which the traveller now finds it. The emigrant farmers settled in the country evacuated by Moselekatse; and the tribes which had fled from him in all directions a few years before, also returned to their former districts; for the emigrant farmers were able to occupy only a small portion of the rich and beautiful country to which they had now fallen heirs. I do not stay to describe the Transvaal country or to note the events of its history. I would only remark that, with defined boundaries, with perfect freedom in its exercise of self-government, and with peace outside its borders, there is doubtless a period of prosperity before the Transvaal, which will be hastened by those important mining industries which are no doubt destined to affect its history, as they have done that of Australia and California.

Following the steps of the Matebele, we find that they proceeded northward, clearing the country before them, till part of the tribe reached the Zambesi River, with the intention of crossing it. In this, however, they were unsuccessful; and the thought of remaining in what is now called Matebeleland was probably developed into a resolution by their success in recovering their cattle from the farmers of the Transvaal on the only occasion on which the latter ventured to carry war into Matebeleland. The Boers succeeded in capturing some Matebele cattle, and in conveying them a certain distance southward, but were then assailed by the Matebele army in the night, and the cattle retaken. This was the last occasion on which the Transvaal farmers and the Matebele had an engagement. For many years the Matebele were quite cut off from the outside world.

The first wagon-road from Shoshong to the Matebele country was made by Dr. Moffat, who was accompanied and much assisted by Mr. Samuel Edwards, himself the son of a Bechuanaland missionary. The road to the Lake Nghabe was made by Dr. Livingstone, and so was the road to the Zambesi. Dr. Moffat had visited Moselekatse while the latter was living in what is now the Transvaal, and had made the most favourable impression on the mind of the great chief. The signal success of Dr. Smith's expedition was also much owing to the fact that Moffat accompanied it. After his flight northwards, and the lapse of many years, Moselekatse was greatly pleased that he had been "found out," as it were, by his former friend, and Dr. Moffat and Mr. Edwards were received with much kindness and attention. At a later date (1859) a missionary party were introduced into the country by Dr. Moffat with Moselekatse's consent, and they were given the station of Inyate for their residence, and on the whole they have been well treated, considering the wild and bloodthirsty character of the people among whom they live. However many head-men may have been put to death on some trumped-up charge of witchcraft, the missionaries, and the traders, who soon followed them, and their property, have been perfectly safe. Their direct success as missionaries, from a statistical point of view, has been small indeed. If they have enrolled a church at all, it is quite a small one. But the social change which has taken place through their efforts in the amelioration of Matebele society already amounts to a revolution, and no doubt in due time the spiritual results will also become apparent.

Dutch-speaking men from the Transvaal soon followed the English into Matebeleland, and asked and obtained permission to hunt elephants and other large game. This was another way of instructing the Matebele in arts of peace; they soon came to see the value of ivory, ostrich feathers, and the skins of game; and gradually the chief recognised the right of the common soldiers to the possession of individual property. But the beauty of the country in which they were hunting from year to year had made a deep impression on the Transvaal men, and their Zulu guides reported to the chief that they were giving certain places new names in their own language, as if they wanted to take the country. This gave the chief the occasion, for which he was no doubt on the outlook, of forbidding farmers from the Transvaal from hunting in Matebeleland and Mashonaland.

Sir Charles Warren sent on a party from Shoshong to announce to Lobingula that Her Majesty had assumed a protectorate in North Bechuanaland, as well as South Bechuanaland, and that Khame was now under the protection of Her Majesty. The party was well received by the chief, and it is remarkable that their head was Major Samuel Edwards, who, thirty years before, had assisted Dr. Moffat in finding out where the Matebele tribe was. Lobingula expressed himself in a friendly way with reference to the English, and wished to know what boundary-line we would give him. Of course no Zulu or Matebele would speak respectfully

of Bechuana or Basuto, as the latter do not belong to the warlike races. Yet Lobingula, as is well known, has a personal regard for Khame, and has expressed his admiration of his character. Both Moselekatse and Lobingula have the highest appreciation of the English, and there is no reason to doubt that, if our affairs are well managed in these regions, a pacific and favourable arrangement may be made with the chief.

MASHONALAND.

Mashonaland lies north, north-east, and east of Matebeleland. As I have already said, the Mashona have been wellnigh destroyed as a people, along with the Banyai and Makalaka—these tribes being closely allied in language, and in manners and customs. They are the best husbandmen in South Africa; have the greatest variety of grains and fruits; are the best workers in iron; grow also their own cotton, and weave it themselves into blankets and shawls. They are darker than the tribes to the south of them, but, as you are already aware, are of the same Bantu family.

Mashonaland is perhaps the finest country in Southern Africa; its low-lying parts being apparently richer than those of Natal, while its high-lying reaches are capable of rearing wheat and other productions of a more temperate climate.

The discovery of ancient gold mines in Bechuanaland, Matebeleland, and Mashonaland by Herr Mauch and Messrs. Hartley and Gifford, in 1866, was an event the due importance of which has yet to be fully realised. For, about the same time, the discovery of diamonds took place at a point much nearer the southern ports, and this was followed by the discovery of the Transvaal gold mines. The loose European population which is attracted to some new "rush" or discovery would inevitably have found their way to the northern gold-fields but for the discovery of diamonds and gold much further south. The diggers, of course, asked themselves and one another, as the shopman asks you in large characters on his windows, "Why go further?" And so Matebeleland and Mashonaland gold is held fast in those secret and well-guarded store-chambers of nature till the hand of intelligence and industry appears to open the door and bring forth the treasure.

The first idea of the Matebele, when they heard of the riches of the country which they had devastated, was that white men might be allowed to take away the "stone with the metal in it;" a white man might load up these stones as he loaded up ivory; but he must not build a house, and he must not bring wife or children, nor must he bring his stock to depasture. When, however, they found that this was not the way in which gold could be worked, they became very uneasy, expecting, of course, an invasion of white men. The Transvaal Government increased this feeling by sending a messenger to the chief, requesting that he would cede to the Transvaal the right to conduct the mining industry in his country. Not only was this not acceded to, but the messenger himself

was glad when he found himself safely beyond the border of the Matebele country. The fact was, the Matebele discredited the professed anxiety of the Transvaal people to engage in gold-digging, and regarded his professed business as a blind, and the messenger himself as a spy.

No one has worked these northern mines except at Tati, which is outside the Matebele country, on the south. It is said that Lobingula has already granted "concessions" to certain white men of gold mines in these auriferous regions. If these men were to commence operations they would be able to prove that Lobingula really understood what the paper meant which he signed. In Swaziland such grants have been made by the natives to gold companies, who are working their mines, and no incoming government would overturn rights which are thus evidently conceded by the native owners of the country. But papers signed in secret, and kept in secret, would probably occupy quite a different position in the eye of an incoming European Government. What the Matebele refused, when asked by the messenger of the Transvaal, and what they would resent if attempted by force or surreptitious means, they will grant to Her Majesty's Government when the subject is rightly brought forward. The Matebele now know the great value of the metal which is found in the quartz and in the river sand of Mashonaland, when the industry of white men has been applied to it. They know also that the same gold is at present of no value whatever to them, as they do not attempt to procure it for themselves. If our Government is what it always loudly professes to be, this gold region should be opened up and worked without bloodshed.

Many of you are aware that all the gold region which I am now describing has been worked before at some very remote period in human history—by whom, no one knows as yet with certainty. But from the fact that the ruins of stone forts are found wherever there were large gold workings, it appears to me that the mines were worked by people who were strong enough to hold their own with the help of those forts, but who had not made themselves the actual or undisputed masters of the country. A few days ago I came upon an illustration by the well-known traveller and artist, Mr. W. Simpson,¹ of a tower of refuge, which is actually in use on the Persian frontier in case of a Turkoman attack. The people throw aside their spades or hoes and flee to the tower, while the Turkomans seek to cut them off. The ornamentation of this tower on the Persian frontier is similar to that on the old forts in South Africa. We must go back, then, in imagination to the earliest times, and see in these forts the work perhaps of Phœnician workmen, who dressed the hard stones carefully till they were the shape of a common brick, only broader and not quite so thick. With such stones they raised walls which in one place are still 30 feet high. They are 10 feet broad at the foundation, narrowing as they ascend, and are built without mortar.

¹ *Harper's Magazine*, March 1886; *Illustrated London News*, 25th April 1885.

Immense forest trees are found within some of those ancient enclosures—trees which have taken many years to grow.

Perhaps the Phœnician fleet from the Red Sea or the Gulf of Akabah brought those early adventurers and workers, who, exploring westwards from Sofala, reared fort after fort, holding the mine and smelting the ore in a hostile country. It would appear certain that the gold mines were worked from the east. The best forts are towards the east—the greatest number of men had been sheltered there; northward there were smaller forts, as far as the region of the Zambesi; southward, as far as the Limpopo, and perhaps further south; westward, there are ruins beyond the longitude of Tati. Such was the extent of the gold-field which these ancient people worked from the East Coast. When they departed from the country, they seem to have left no record or tradition of themselves behind. Were the workers cut off entirely by the sudden appearance of warlike and powerful people, or were they suddenly called out of the country, as were the Romans from Britain? We at present have no means of knowing. But the district to which I am referring is all but unexplored; for those who have visited it, and have brought out the information which we now possess, made no thorough search for archæological remains. Milton, in *Paradise Lost*, guessed that Sofala might be Ophir, and the guess of our great poet will probably be fully proved in the course of time to be historical fact.

I fancy I hear some one say, "You are doing the worst service you could for that country by letting it be known that these are old workings, and especially by hinting that such sharp people as Jews or Phœnicians worked them and then gave them up. Depend on it, there is not much gold left," our cynical friend will say. But I beg you again to notice that a person in my position has, of course, to tell that which is, as far as he knows it; and secondly, I stated that while we knew the mines had been worked, we were in entire ignorance as to why that working had been given up ages ago; thirdly, and most satisfactory of all, gold has been found in reefs in districts which have never been worked; and in places such as Tati, where English skill and energy have done something in the working of one out of several mines, the quartz is found at no great depth quite uninterfered with by human hand at any previous time, and, as I can myself testify, of surpassing richness.

THE WORK OF THE IMPERIAL GOVERNMENT IN SOUTH AFRICA— SHIRKING IT AND FACING IT.

Whilst the British Government has carried on the affairs of South Africa for more than eighty years, we have done so without a settled policy, and, indeed, in great ignorance of the country which we were governing. Mr. Gladstone, in 1881, well described our habitual attitude in South Africa:—"We have been striving against a series of difficulties, and endeavouring to stave off the evil days." Sir Hercules Robinson, the present High Commissioner, speaking in London in

1884, said : "The question of frontier policy remains the most difficult one with which we have to deal. Heretofore, as regards border troubles, this country has alternated between doing nothing and fighting." But while it has unfortunately been true that we have had no settled policy in South Africa, it is equally certain that we have cherished high aims in that country ; and in a rough, blundering, and most expensive manner we have secured those aims. Our first action was to give freedom and citizenship to the Dutch-speaking people, whom we found in two separate places in the Cape Colony in revolt against the former Government, which held them as serfs rather than as free colonists. Thus, for all purposes of comparison with other colonies, it is only fair that the real beginning of the colonial history of the Cape should be reckoned from the commencement of this century. Britain next proclaimed that all who were not in actual slavery should enjoy the rights of citizens before the common law. This was a wise enactment, and has had a most beneficial tendency ; but of course it met with some opposition from the more ignorant borderers at the time it came into practice. The next action of Britain was the emancipation of her slaves in all parts of the world, and necessarily at the Cape. The coloured population of the Cape Colony, descended from these slaves and serfs, form the very useful, and, on the whole, well-behaved labouring population of to-day. Consider for one moment the magnitude of the deliverance which was thus effected by Britain for the European population of South Africa. We are slowly spreading northward. Had it not been for Britain, we should have been doing so as an enslaving and slave-holding community. In the history of the United States, we can read the convulsion and the bloodshed from which Britain has saved the Europeans and the natives of South Africa. In the United States the slaves were few and the white men numerous, and yet how tremendous was the struggle before the wrong was righted ! In South Africa the natives were far more numerous than the whites. If the enslavement of a few brought such dire results upon the whole United States, what must a slave-holding policy have entailed upon South Africa ? Education and Christianity would have done their usual elevating and ennobling work among the enslaved. Inevitably, and by the same influence, the European society itself would have been split into slaveholders and abolitionists. The mind is appalled at the contemplation of the dark and fierce struggles, with the inevitable blood-stained convulsion, which must have characterised the history of South Africa but for the guiding ideals of Great Britain—a country which, with all its faults and its meanesses, holds its present position in the world because its people are righteous and fair-dealing at heart ; and it will continue to exist, and to prosper as an empire, so long as its people are righteous, especially towards peoples weaker than themselves.

I have already said that the tendency of the European population in South Africa is to spread northward, just as the same people spread westward in America. One great mistake which Britain made was to allow

the formation of separate European governments outside the Colony. We have now the example of the United States of America in this matter. They fought to retain that unity which we, unfortunately, permitted to be destroyed in South Africa. It was thought to be a master-stroke of policy at the time: it was simply the result of great ignorance of one another on both sides; and while it was a signal disservice to the colonists who remained under our rule, it was especially so to those who were permitted to set up their own Government. When the eyes of statesmen were opened to the nature of their action, there was undue haste exhibited to reunite the separate parts; and you know the unhappy results which followed. Perhaps our position in 1882 in South Africa was at its lowest ebb. There was little to show for the Imperial Government in the country itself; and in men's minds on this side there were only disgust and impatience. A step or two more in the same direction, and we should have lost the country entirely. But a change took place. You remember the visit of the Transvaal delegates to this country, and their earnest efforts to obtain possession of Bechuanaland, which they knew to be the key to the interior. You know also that they failed: and that, with the columns of the English press open to them, and Her Majesty's Ministers most attentive to all their representations, they were unable to establish the justness or reasonableness of their cause, and went back to the Transvaal without securing for that State the pre-eminence and supremacy which the possession of Bechuanaland would necessarily have conferred on it. But the opponents of British supremacy were not yet baffled. The struggle was eagerly and hopefully renewed in South Africa; with a high hand the Transvaal influence directly and indirectly asserted itself; and for a time it appeared that that State was to win there what it lost here. No firmness of conviction or clearness of purpose characterised our action at the Cape in opposition to this. But again the intelligent convictions of the British people asserted themselves, and the Bechuanaland Expedition was despatched to uphold the interests of peace, progress, and righteousness in South Africa. The struggle was now recognised on all hands to be one for supremacy—coupled on the one hand with orderly development; on the other with filibustering. That struggle has been decided in the way that all loyal colonists—Dutch-speaking as well as English-speaking—most earnestly desired; and Britain guards, in the interests of all South Africa, as well as her own interest, the northern highway of commerce and civilisation.

The enlargement of the Bechuanaland protectorate by Her Majesty's Government in 1885 has been referred to already. As a development of the policy recently embarked on, it was an act of the very utmost significance and importance—needing only to be wisely followed up. Our whole attitude in South Africa had been unworthy of a practical people, accustomed to the administration of outside territories, and among less instructed races of men. We have always had our backs turned to South Africa, and viewed its affairs—so to speak—over our shoulder. Were

ever affairs well managed in that way? Let the professor try that attitude before his class—or the artist before his canvas—the speaker before his audience—the merchant at his desk—or the ploughman at his plough-stilts—and you all know what the results would be.

Well, Britain changed its attitude towards South Africa in 1883, when it reassumed the protectorate of Basutoland, and refused Bechuanaland to the Transvaal; it confirmed this in 1884, when it sent out Sir Charles Warren to establish order in that country, and in 1885, when it announced at Berlin its protectorate over Khame. You are aware that that expedition was successful in Bechuanaland. Why Sir Charles was recalled before the affairs of Zululand and Swaziland were settled, and our Imperial administration consolidated in native territories, are questions which are often put to me, but this is a phase of the subject upon which I shall not enter to-night. It became Sir Charles Warren's duty to inform the chiefs in North Bechuanaland of the extension to them of Her Majesty's protectorate, and in accompanying him I found myself everywhere among old friends. I hold that the treaties which have been recently made with chiefs in Bechuanaland begin a new chapter in our history in South Africa. So far as I know, no such transactions have taken place there before; it reminds one of the dealings of Penn and the Indians in Pennsylvania.

When an intelligent chief, like Khame, offers his territory, and asks our administrative assistance, our highest interests, as well as our sense of duty, lead to our yielding our assent to a proposition so reasonable and so beneficial to all parties concerned. I have not time to enlarge on the direct benefit to this country of having such an immense unoccupied healthy region placed at our disposal by its native owners—not in the hands of a Colonial government, but in the actual possession of the local representative of the landless people of Great Britain. I find people arguing as if the appointed bounds of our habitat were the shores of this island. People huddle together—they tread one another down in our crowded cities—while hundreds of square miles of territory support only the antelopes and other game, with their scattered Bushmen hunters. The game on the prairie does not make the blunder which men are here making. I have seen giraffes and elands, buffaloes and gnus, zebras and gemsbok, rooibok and springbok, all scattered in herds on the prairie, and finding their appointed food from leaf, or fruit, or grass. It is left for man alone to huddle together and starve, and insist on it that the workers and solvent men of a district shall support those who cannot get work there; and a man must have work, too, of the one kind to which he may have served an apprenticeship. Surely our habitat includes those beautiful unoccupied countries. Surely the American and the Colonial idea is the more masterful and nobler, that a man will turn to any kind of work—I do not say rather than starve, but rather than fail in the race of life. But over here, I am afraid such manly independence is being gradually undermined.

I am acquainted with the wants and aspirations of the natives of South Africa, and I have endeavoured to explain these to you to-night. I know also the colonists, and regard myself as one of their number; and you will allow me to say that they have shown in the Cape Colony that they, too, regard me in this friendly light. I have also had some opportunity of meeting with statesmen, philanthropists, and politicians in this country. I am glad to say to you to-night that I have no depressing story to tell you. I only beg for more attention to the subject. I have no hesitation in affirming that the development of South Africa can go on in peace with the full consent of the natives, and to their advantage, under the management of the Imperial Government. The question of expense depends upon our promptness and intelligence in acting. We must be in possession before filibustering commences. The control of the incoming European population must be in our hands; and, in that case, each territory, in the hands of a High Commissioner, would more than pay for its own administration. Gentlemen, here is the great administrative work for Britain in South Africa. The Cape Colony, the Free State, and the Transvaal have their several boundaries; and their self-government extends only over the country within these limits. By common consent of Europeans and natives, the great country beyond these boundaries—which is the South Africa of the future—is in the administrative hands of England. Turn your faces and your minds to this question, and view it no longer, as it were, over your shoulder, and wishing you were rid of it.

Facing it in this way, we realise the fact to which I direct your special attention, that the extension of the protectorate northward by Her Majesty's Government so as to include Khame brings us at last to the natural and permanent boundary of South Africa—the river Zambesi; as the territory of Khame, who is under our protection, extends to that river. The co-working of Europeans and Africans north of the Zambesi must naturally be carried on from the east and west coasts. We have at length found the northern boundary of South Africa.

General Gordon, who had been to South Africa, and had studied the subject, expressed the opinion, which I have entertained for twenty years, that there is no special South African difficulty—except that which arises from our own inveterate administrative neglect. It is a country where contact with European society causes the break-up of tribal government; and the one great want in trans-colonial territories is administration and central control. As to European communities in South Africa, it ought to be distinctly known that we have no wish to interfere with them in their local self-government. No doubt it will be they who will want to come to us as the superior power, for the wise consolidation of the general government of the country. The steps necessary for such a confederation must, of course, be taken with due deliberation, and, no doubt, after the lapse of some time; but in the meantime all Europeans in South Africa, and especially the youth of the

country—whether in the Cape Colony or the Free State—would be attracted to the office of the representative of the Queen, on account of the extent of unoccupied land under our control. For the first time in our South African history, we shall be able to satisfy the legitimate and reasonable wishes of emigrants from this country, as well as of loyal and law-abiding Europeans in South Africa, of whatever nationality, without interfering with any of the actual possessions of the natives.

I am not here to speak of the duties of natives or of colonists. I have had opportunities for enlarging on these points to native audiences in Bechuanaland, and to colonial meetings in various places in the Colony. I have not been remiss in directing their minds to the side of the question which belongs to them. I wish here to speak of Britain's opportunity, and Britain's duty in South Africa to-day. There seems to be a hesitancy which, I am afraid, is begotten of indecision rather than of calm deliberation, and which is fatal to our success, as well as to our reputation. The affairs of Zululand and Swaziland, as well as our recent attitude in Bechuanaland, are illustrations of this. It has come to this in Swaziland, that a gold-mining company have actually offered to contribute £500 per annum towards the salary of a British Resident in that country. The formal answer, with reference to Swaziland, is that its affairs are under the serious consideration of Her Majesty's Government. If the serious attention of British statesmen and administrators were really turned to Zululand and Swaziland, it would be possible yet to evolve order, and something like a working scheme, out of the present uncertainty and the past chaos.

Separate Imperial work, of the nature and importance indicated, demands the attention of a specially-qualified officer solely to represent Her Majesty's Government in South Africa. At present there is no such officer. Imperial and general South African interests enjoy a fraction of Sir Hercules Robinson, who is at present Governor of the Cape Colony, Governor of Bechuanaland, as well as High Commissioner; and they enjoy also a fraction of Sir Henry Havelock, who is Special Commissioner for Zululand as well as Governor of Natal. The Transvaal and Free State sometimes address one of these fractions and sometimes the other—the Special Commissioner for Zululand and the High Commissioner at Capetown. The importance of the great administrative work before the Imperial Government demands the services of a High Commissioner who shall not have any local administrative duties, but who shall be the supreme representative of Her Majesty's Government in South Africa.

The business of this officer would be the correspondence with the Transvaal and Free State. The Cape Colony and the colony of Natal have also border questions, and Colonial and Imperial correspondence takes place, which is at present attended to by the right hand of Sir Hercules Robinson or Sir Henry Havelock, placing a document in the left hand—the Imperial and Colonial fractions of these officers corresponding with one another over important affairs. Such business ought to go before a separate officer, a

real High Commissioner of South Africa, who would hear all sides without local bias. Then the High Commissioner would have the superintendence of the administratorships of Basutoland, Zululand, Swaziland, Pondoland, and Bechuanaland, North and South. To these might be added, in answer to local petitions, the Transkei territories—of course, with the acquiescence of the Cape Government.

In each and all these places there is the loudest call for administration; and it is to our discredit that it has not been sooner supplied. The present method has not worked well, either for the public interest or for the comfort of the holders of the office. It has been complained of in the Cape Colony as impeding the exercise of their responsible government; in Great Britain the combination of these offices may be said to have been condemned by the entire press of the country. Such men as the late Mr. Forster demanded that there should be a separate High Commissioner. Earl Grey has repeatedly urged this view. Sir Charles Warren, having himself filled the office of Local Administrator of Griqualand West, and more recently of Special Commissioner of Bechuanaland, holds strongly that the High Commissionership should be severed from the Governorship of a colony. Baron von Hübner, a distinguished Austrian statesman and diplomatist, in an interesting work recently published, *Through the British Empire*, declares that the present arrangement, in virtue of which the Governor of the Cape Colony is also High Commissioner, is "an anomaly difficult to account for." No business was ever successfully conducted on our present methods in South Africa, and a change is imperatively demanded. I believe that this is fully recognised at the Colonial Office, and is probably what is meant by the repeated statements you hear from time to time of a contemplated comprehensive and definite scheme.

I shall bring these remarks to a close with a homely illustration. One of the trials of parents who have only a very limited income, is the fact that their children will grow—legs and arms will leave behind the limits of the garment. Surely it is useless to scold the child. I understand it is possible sometimes to "let the dress down;" at other times it seems it has to be "made up;" but when legs and arms have once more stretched out into their old relative positions to the garment, there is nothing for it but to provide a new dress—made, of course, with reference to the obvious fact that it is "for a growing child." Now, ladies and gentlemen, here stands this child, South Africa—as seen on the map—grown away from her administrative garments. Don't scold her; she has only grown. Remember, *you have never once considered her growth, or made the slightest provision for it at any time.* You can't botch that garment any more. You have "let in" a Special Commissionership here, you have patched on a Governorship there; but the new cloth and the old do not agree, and the rent is made worse. Now look at your sightly growing child—*supplied by you, I repeat, with nothing for her growth or development—only staving off the evil day with that patched, "made up"*

and "cut down" garment! Are you not ashamed of yourselves? I know well that there is always some excuse. At one time it was said practically that British nerves would not stand the care of our large growing family. People have got over that idea. At present people tell me there is a disturbance among the three elder sisters of the family—an elegant damsel, with dark-blue eyes, objects to her garment as too heavy and tight-fitting, and wants it altered. But you know parents would be ashamed to make an argument of that kind. One child must not have bare legs and arms because one of the elder sisters raises a discussion, if not a disturbance, as to her garment. While she receives the fullest attention, it must be remembered a Government is not one department; and one is pleased to think that the present Colonial Secretary, Sir Henry Holland, has full opportunity to contemplate the too-short administrative garments provided for South Africa, and to ponder the amazing fact, which I repeat once more, that we have never made any provision whatever for the growth and development of South Africa. From his recent public utterances, one gathers that this is the present attitude of the Colonial Secretary; and I confess I am looking for a reasonable and feasible provision for the development of our South African Dominion, from the personal attention of so experienced an officer in Colonial affairs as the present Secretary of State. My great hope, however, is neither in officials nor governments, but in the informed and intelligent public opinion of this country. You lately saved South Africa for Britain; your present work is not to rest satisfied till due provision is made for the development and good government of the great country which is in our hands.

PROCEEDINGS OF THE SCOTTISH GEOGRAPHICAL SOCIETY.

THE last Ordinary Meeting of the current Session was held on Thursday, 12th May, in the Queen Street Hall, Edinburgh. The Right Honourable Sir Thomas Clark, Bart., Lord Provost of Edinburgh, Vice-President of the Society, presided, and there was a large attendance of Members. Dr. Wilhelm Junker read a Paper on his *Travels in Central Africa*, an abstract of which will be published in the Magazine for July, the Paper not being the property of the Society. On the conclusion of the Paper, a cordial vote of thanks was awarded to Dr. Junker on the motion of Sir Douglas Maclagan, seconded by Mr. Æneas Mackay.

On the following evening, Dr. Junker read his Paper before the Dundee Branch of the Society, Principal Peterson, the Convener, being in the Chair. Captain Clayhills Henderson moved the vote of thanks to Dr. Junker.

An Extraordinary Meeting of the Society was held in the Merchants' Hall, Edinburgh, on the afternoon of 20th May, Dr. George Smith, C.I.E., presiding. Dr. Robert W. Felkin communicated the Paper he had received from Emin Pasha, which is published in the present number of the Magazine, and explained

the nature of the discovery by Emin Pasha of the two rivers flowing into the south-west end of the Albert Lake. On the motion of the Chairman, a vote of thanks was awarded to Dr. Felkin for reading the Paper, and to the Merchant Company for placing their Hall at the disposal of the Society.

GEOGRAPHICAL NOTES.

EUROPE.

Depth of Loch Morar.—Mr. John Murray, of the *Challenger* Commission, visited this lake on April 29th, and made a series of soundings along the central line. For the greater part of its length the loch exceeds 100 fathoms in depth, and the deepest sounding, obtained off Tarbet and nearly in the middle of the channel, was 175 fathoms or 1050 feet. The surface of Loch Morar is 30 feet above sea-level; the loch runs east and west, is about 12 miles long, and, on an average, 1 mile wide. This is the greatest known depression below sea-level in Great Britain, and, with the exception of the Norwegian fjords, the greatest on the European plateau. The interest of the result of these soundings is a strong argument for the thorough survey of deep lakes, which was urged in Mr. Webster's paper in the Magazine, vol. i. p. 491.

Norway.—We have recently received from the Norwegian Central Statistical Bureau a series of publications, giving statistical information on the subjects of Crime (1883); Health and Medicine (1884); Shipping (1885); Railways (1884); and the fourth volume of General Statistics (*Meddelelser fra det Statistiske Centralbureau*) for 1886. From this last we extract the following particulars:—

Area.—The total area of Norway amounts to 124,666 square miles. Of these 18,295 belong to the *amt* of Finmark; but these last figures are somewhat uncertain.

Population.—According to the communal census, taken on 31st December 1885, the urban (*Byer*) population numbered 426,379 persons, against 353,392 at the general census on 31st December 1875, showing an increase in the ten years of 72,987 persons, or 20·7 per cent. In East Finmark, according to the communal census of 31st December 1885, the urban population numbered 6877, against 5187 on 31st December 1875; and the rural population 8293 in 1885, against 6797 in 1875. The total population of the *amt* of Finmark rose, therefore, from 11,984 in 1875 to 15,170 in 1885, showing an increase of 3186, or 26·6 per cent. Of the total in 1885, distributed according to nationality, 7241 were Norwegians, 4064 Quæns, 2336 Lapps, and 1529 of mixed Quæn and Lapp blood.

Tunnelling the Pyrenees.—In the *Revue de Géographie* for May 1887, this important subject is referred to in a quotation from a recent speech by M. Castelar, the Spanish statesman, who announced that the Spanish Government had resolved to do its utmost to effect the tunnelling of the Pyrenees for railway transit. This tunnelling was proposed to be at two places, viz., Canfranc and Noguera Pallaresa, and the utility of such double tunnelling was deemed uncontested. By the line of Canfranc, the railway from Paris to Madrid would open up an exceedingly fertile part of Spain, the produce of which would be

able to be placed on Parisian tables the day after it was gathered from Spanish gardens and fields. Thus a great impetus would be given to the agriculture and commerce of Spain, a country which has too long been shut off from the rest of Europe. By the line of Noguera Pallaresa again, Algiers would be approached, and all its rich products could be conveyed to Europe by this railway after they had been landed at the Spanish seaports with which the railway would communicate.

ASIA.

Arabia.—From Herr Glaser's general account of the peninsula of Arabia, contained in Nos. 1 and 2 of Bd. xxx. of the *Mittheil. d. k. k. Geogr. Gesellsch. zu Wien*, we extract the following particulars :—

Arabia, with an area about four times as great as that of Austria-Hungary, has a population of fifteen to twenty millions. An Alpine chain (Serat), whose peaks form a crest from 8500 to 9800 feet in altitude, extends all along its west side from the extreme south up to Syria. From this chain there is a gradual slope eastwards towards the Persian Gulf. The southern edge of the peninsula is likewise formed by a mountain mass, which sends out its spurs as far as Muscat (Maskat) on the east. The interior is furrowed by numerous streams, which contribute their waters to the Wady Ed-Dawásir. South of this extends a complex of elevated deserts. But whilst the interior is arid and but sparsely populated, the coastal fringes are rich and productive, and consequently are well cultivated. The slopes of the mountains, too, on both sides alike, yield several valuable commercial products. Passing over Herr Glaser's treatment of the fauna and ethnography, we come to the important matter of climate. All along the coast it is intolerably hot and moist. In Hodeida the thermometer frequently rises to 104° Fahr.; its minimum record in the coldest months never descends below 57°. Of course, in the higher regions it has a more temperate range. Even at San'á (7284 feet) 93°·2 is often registered in the hottest part of the year; and in winter, although ice is formed during the night, yet the thermometer records 68° after noon. In the mountainous districts there are two regular periodic rainy seasons, a minor one in March, and a major one in July, August, and September. On the elevated plateaux, in consequence of the extreme dryness of the atmosphere and the extremely rapid evaporation, water freezes even at some degrees above zero (Celsius). The peculiar mist (*umma*) of the Tihama, or low coastal fringe in the south-west, has been mentioned in vol. ii. p. 233. As a consequence of the above-sketched climatic conditions, Southern Arabia is extremely unhealthy for strangers; and this applies to the higher plateaux equally as to the low coast regions.

Soundings in Gulf of Arabia.—The following soundings were taken (*Annalen d. Hydrographie, Heft iv.*, 1887), by the U.S. steamship "Essex," between Cape Guardafui and Ceylon, from November 20th to December 2d, 1886. In the Indian Ocean, that is, that part of it called the Gulf of Arabia, between 60° and 70° E. long., there prevails a tolerably uniform depth of about 2500 fathoms, which gradually decreases on both east and west as the shores are again approached. The greatest depth was, however, found at 2705 fathoms, off the African coast, about 160 sea-miles from Cape Guardafui. A second deviation from the uniform depth of 2500 fathoms exists to the east of the maximum depth, where there is an important rise of the sea-bed to within 857 fathoms of the surface. A sounding taken one sea-mile south of the island of Manicoy gave a depth of 1057

fathoms, pointing to a somewhat steep rise in the sea-bottom. The following tabular statement shows the details of each particular measurement :—

N. Lat.	E. Long.	Depth in Fathoms.	Character of Sea-bottom.	N. Lat.	E. Long.	Depth in Fathoms.	Character of Sea-bottom.
11 11	53 53	2705	Mud.	8 45	71 5	2120	Mud, sand.
10 12	55 55	857	"	8 32	71 59	1594	" "
10 3	56 16	2367	Mud, sand.	8 26	72 30	1229	Sand. "
9 50	57 49	2364	No specimen.	8 21	72 49	1130	Mud, sand.
9 43	59 40	2306	Mud, sand.	8 14	73 1	1057	" "
9 40	60 2	2243	" "	8 11	73 14	1202	" "
9 28	59 49	2228	" "	8 6	73 33	1271	" "
9 15	59 47	2060	" "	7 57	73 56	1466	" "
9 34	60 8	2083	" "	7 45	74 42	1537	Mud. "
9 29	61 46	2511	Mud.	7 40	75 27	1002	"
9 29	63 16	2535	"	7 41	75 51	859	"
9 17	64 53	2497	Mud, sand.	7 41	76 14	827	Mud, sand.
9 5	66 22	2488	" "	7 41	76 37	63	" "
8 57	67 53	2498	" "	7 6	78 30	1401	Mud. "
8 52	69 30	2568	" "	7 2	79 30	685	Mud, sand.

Earthquakes in China.—Among the more important earthquakes which have occurred in China, records have been kept of the following :—In 79 B.C., shocks of such very exceptional violence were felt that large portions of the mountains are said to have been bodily detached and thrown down into the valleys. In 114 of our era, the earth opened in several places. In Shan-Tung, in the year 1399, a seismic disturbance destroyed the town in which Matthew Escandel, had, a few days before, suffered martyrdom. The river on or near which it stood ceased to flow for five days ; then the earth opened, and discharged from the chasm a flood of waters which inundated the city. On 1st, 3d, and 4th of February 1556, in Quang-Tung, in consequence of a violent earthquake shock, the entire region round Canton known as Sansy, over a radius of about 60 leagues, was entirely inundated, only one child of the inhabitants escaping from the disaster. Peking has been the centre of seismic disturbances in 1665, on 2d September 1679, on 11th June 1720, and on 30th November 1730. By the second named—that of 1679—a great part of the city was destroyed, numerous temples and palaces, towers and walls, being thrown down, and 400 persons were buried under the ruins. In a neighbouring town the disaster was still more appalling, and 30,000 persons perished. Earth tremors continued to be felt for three months afterwards. In 1720 a succession of disturbances, lasting over nearly a month, occasioned the loss of about 1000 lives. A remarkable feature characterised the disturbance of 1730. It consisted of a series of sudden uprisings, or disconnected shocks, which left intervals untouched along the direction of their path. On this occasion more than 100,000 persons perished under the ruins of the city, besides great numbers in the villages in the vicinity of the capital. In 1782, on May 22d, a convulsion of an exceptionally violent nature caused the shores of the island of Formosa, next the Straits of Formosa, to be submerged for twelve hours. Tai-Wan, the capital, was destroyed ; the greater part of the island was terribly desolated ; and the configuration of the Straits appreciably modified.

These facts we have taken from a note contributed to the *Comptes Rendus de la Soc. de Géog.* (Paris), No. 6, by M. Romanet du Caillaud. This gentleman

also gives some noteworthy particulars about an island called Maury-ga-sima, which was totally engulfed and obliterated by the sea in some great seismic convulsion like that of 1782. This island seems to have been situated in the neighbourhood of Formosa, probably on what are now known as the Banks of Formosa; probably, too, the islands of the Pescadore Archipelago may be remains of Maury-ga-sima. The island, before being overwhelmed by this cataclysm, constituted a kingdom which, for centuries, was famous for the fertility of its soil, and for a species of porcelain, the fabrication of which formed one of the chief occupations and the chief source of wealth of the inhabitants. The vases of Maury, which were transparent, slender, and in colour whitish, flushed with green, were so highly esteemed that, after the destruction of the island, they were fished up from the bottom of the sea by divers, and sold at prices ranging from £6 to £1500 each.

Manchuria.—An important journey was made towards the middle of last year into a region hitherto unvisited by Europeans, viz., the Chang-pei-Shan Mountains in Manchuria, and the sources of the river Sungari, by Messrs. H. E. James (Indian Civil Service), F. E. Younghusband (Dragoon Guards), and M. H. Fulford (Chinese Consular Service). Starting from Moukden in May, these gentlemen, by a difficult march across the mountains, reached Mao-erh-Shan, the last Chinese outpost, on the river Yaloo or Ai-Chang, 236 miles from the capital. At this point they were compelled, owing to the rapids in the Yaloo, to strike off northwards up one of its affluents. Then, crossing the watershed by a pass 2700 feet high, they descended the Tang-ho to its confluence with the Sungari. Thence their itinerary lay for nine days through forests and marshes to Mount Pei-Shan (White Mountain), which gives its name to the country. This mountain is an extinct volcano, whose crater is occupied by a blue-watered lake, 6 or 7 miles in circumference, and discharging by a stream into the Sungari. Mount Pei-Shan has no glaciers, and its culminating peak is only 7525 feet above sea-level. Its sides, which are very steep, are composed of disintegrated pumice, which at a distance looks like snow. The Pei-Shan range forms the centre of the hydrographical system of Manchuria. The return journey was taken by way of Kirin. The country traversed abounds in wild animals, especially tigers; coal is plentiful, and auriferous deposits occur.—*Bull. de la Soc. de Géogr.* (Marseilles), 2^{me} Trimestre, 1887.

Bali.—Part iv. (2nd series) of *Tijdschrift van het Nederlandsch Aardrijkskundig Genootschap*, contains a very readable paper on the native population of Bali in the East Indies, from the pen of Count van Limburg Stirum. This island was overrun in the fifteenth century by Hinduised Javanese, who have left permanent traces of their supremacy in many customs, and particularly in the style of temple architecture which prevails in Bali. The villages contrast strikingly with those of Java, for every family has its own homestead surrounded with an earthen wall. The roofs of reed and (in part) tiles overhang the house walls. Access is gained to the interior of the homestead by gateways, which are adorned with sculptured work, and are narrower at the top than at the bottom, thus suggesting the appearance of Egyptian mausoleums. "A village in Bali gives the impression of a collection of little hiding-places; and this impression is deepened by the artificial hillocks and holes which one sees along the roads." The writer dwells at considerable length upon the religion of the people and their temples. They are, in the main, adherents of Hinduism; of the Hindu Trinity, Siva is held in most veneration; but they have also a multitude of

other gods, and believe in the influence of spirits. Along with the Hindu religion, the caste system prevails. After speaking of the dress of the people, Count van Limburg Stirum passes on to treat of the regulation of matters connected with irrigation, and concludes with some notice of the dramatic representations and the system of cremation which prevail in the island. One of the most inveterate habits of the people is cock-fighting; of this predilection advantage is taken by the native chiefs to levy a sort of poll-tax, by forbidding their subjects to engage in the amusement in private, and compelling them to attend official meetings organised and controlled by government.

AFRICA.

Letters from Emin Pasha.—Four letters from Emin Pasha, and the paper which we publish in this month's Magazine, were received on 9th May by Dr. Robert W. Felkin, of Edinburgh, a member of the Society's Council. These letters were given in the *Scotsman* of 10th May, almost *in extenso*. The latest, dated from Wadelai, 26th October 1886, we partly reproduce as an Appendix to Emin Pasha's paper, which it supplements. In his other letters, Emin Pasha gives some interesting particulars of his present position in the Egyptian Equatorial Provinces; he declares that the East Coast routes to the Provinces are practicable, and that the Uganda route is open; and announces, with great gratitude and increased hope, the safe arrival of Dr. Junker's caravan. Dr. Junker, on his arrival in Brussels, after his visit to Edinburgh, also received letters from Emin Pasha. One, dated 18th December 1886, gives the latest news yet to hand. Emin Pasha states that he has received news and supplies through an Arab named Mahomet Biron, formerly employed as escort. Mahomet Biron brought to Emin Pasha arms, provisions, and various other supplies. King Mwanga of Uganda, who, as already announced in the letter received a month ago by Dr. Junker, would not permit Emin Pasha's passage through his territory in 1886, on this occasion allowed Mahomet Biron to pass through his country to reach Emin Pasha, and even permitted him to return to obtain fresh supplies.

A Reuter's Telegram from S. Paul de Loanda, 26th May, announces the arrival of Mr. Stanley's Expedition at Leopoldville on 20th April, all well, and the departure of the main body nine days later.

Portuguese West Africa.—The *Deutsche Kolonialzeitung* (Nos. 4-7) contains a series of papers by Herr Otto von Dewitz, who has attempted, but unsuccessfully, to found a settlement on the Cunene. The principal places visited by Herr von Dewitz were Mossamedes, Huilla, Humpata, Caconda, and Luceke. Some seven years ago, a party of Boers from the Transvaal—about 50 families in all—left their native home and “trekked” through the Kalahari Desert north-westwards until they reached Portuguese territory, where they finally settled at Humpata, a place situated fourteen days' march inland from Mossamedes, at 5000 feet above the sea. The route inland ascends the steep Serra de Shella, a range having its long axis in a north-south direction, and attaining an altitude of about 7000 feet. This range forms the edge of the interior highlands or South African plateau; it also serves as the watershed separating the short streams that seek the Atlantic on the west from the tributaries of the Cunene on the east. Towards this last-named river there is a gradual slope. Luceke is situated at the point where the Cunene receives its right-hand affluent, the Catapi. The soil on this elevated plateau is very fertile, yielding at Luceke, manioc, beans, squashes, maize, and a species of wheat. It is rich in iron. Wax

is one of its principal productions. Its broad expanses of grassy prairie, traversed by numerous streams and brooks, offer suitable pasturage for cattle. The climate, owing to the elevation, is moderately temperate; indeed, to the south of Caconda, the nights are so cold in June that ice has been formed on the surface of water contained in water-vessels. The country is well timbered, and contains much undergrowth. Wild animals, game, and snakes abound.

Fernando Po, Gulf of Guinea.—This island, which belongs to Spain, has a maximum length from north to south of 35 miles, and a maximum breadth of 14 miles. It is situated off the west coast of Africa, 20 miles from the Cameroon Mountains. The interior consists of a mountain system which culminates in Isabella (Clarence) Peak, 10,000 feet high. The shores are indented with bays, which receive numerous mountain streams. The south coast consists of precipitous rocks, and is inaccessible. During the rainy season, which lasts from July to October, the thermometer usually registers 72°-95 Fahr. in the morning, 81°-27 at noon, and 77°-22 at sunset. During the other months of the year it ranges higher. Hurricanes are rare and seldom violent. The principal town of the island is Santa Isabella, on the Bay of the Consul, on the north-east. The chief productions are cinchona, coffee, cacao, and an abundance of tropical fruits. The population consists of Bubis, who differ considerably both in appearance and in customs from other African races. In number they are about 30,000. They are charged with being idle, but are fond of the chase. The people are divided into three classes: the privileged (*butuku*), the middle class (*bututu*), and the proletariat. Order and obedience are maintained by a peculiar organisation of notables called *lohna*.—*Bull. de la Soc. de Géogr.*, Paris, 4 trimestre, 1886.

AMERICA.

Marble Island, Hudson's Bay.—Dr. R. Bell, Assistant-Director of the Geological Survey of Canada, contributes to the *Proc. of the Canadian Institute*, Toronto (3d series, vol. iv., fasc. 2), an interesting account of the above-named island, and from his paper we extract the subjoined geographical facts:—"The island lies about 16 miles out from the north-western shore of Hudson's Bay, in lat. 60° 40', and between long. 91° and 92° W. It has a length of about 25 miles by a breadth of 5 or 6. The surface has an undulating outline, with long gentle slopes; and its general elevation is a few hundred feet above the sea. The harbour used by the American whalers is situated on the south side and near the west end. It consists of an outer and an inner harbour. The outer one is formed by a small island called Deadman's Island, and from it a narrow channel with no great depth of water, which has been cut by nature through a ridge of rocks, leads to the inner harbour, a land-locked basin measuring fully a mile in its greatest diameter." The island and the adjoining mainland are "entirely destitute of timber," but the island grows a profusion of sub-Arctic vegetation. Geologically, the island is composed of masses of white quartzite, largely variegated by coloured varieties. This quartzite is apparently identical with the quartzites of the Huronian series that occur so plentifully on the north shore of Lake Huron. There exist several plainly marked ancient beaches on Marble Island, at 200 to 300 feet, and even higher. The solid rocks of the island are "pretty thoroughly glaciated and the striæ are very distinct."

Lake Mistassini.—From the results of the exploration of this lake in 1884 we make selection of the following facts:—The lake, which is long and narrow, with a string of rocky islands running from end to end of it, lies between 50°

and $51^{\circ} 24'$ N. lat., and $72^{\circ} 45'$ and $74^{\circ} 20'$ W. long. From NE. to SW. its longest line, a slight curve, concave towards the SE., measures nearly 100 miles; its average breadth is about 12 miles. The shores are for the most part rocky, and without beach or marsh. The lake lies at an altitude of 1350 feet, and receives several streams. Its waters, which abound in fish, are mostly very deep. The shore line, especially on the south and west, is much broken. The climate is very severe, frosts occurring in every month except July.—*Bull. of Amer. Geogr. Soc.*, vol. xix., No. 1, where the map of the lake by the Geological Survey of Canada is reproduced.

New Mexico : its Geography, Scenes, and Peoples.—This is the title of an excellent article in the *Bulletin of the American Geographical Society* (vol. xix., No. 1), by Mr. Clarence Pallen. This territory of the United States was first trodden by Europeans in 1540, when Coronado led a military expedition northwards from the newly conquered territories of the Aztec confederacy. It seems difficult to realise that this portion of the American continent was under the dominion of Spain for a period of 230 years. On the liberation of Mexico from Spain in 1821, New Mexico became a State of the Mexican Republic. It was ceded to the United States in 1848 after the war with Mexico, and was organised as a Territory of the Union in 1850.

Its present boundaries lie between $31^{\circ} 20'$ and 37° N. lat., and between 103° and 109° W. long. Its area in 1880 was 122,580 square miles. In 1885 its population amounted to 131,985, made up of 100,000 Mexicans, 9,200 Pueblo Indians, and 22,785 Americans. In addition to these there were 17,200 Navajo and 1790 Apache Indians. Generally speaking, New Mexico consists of high plateaux and mountains. The Rocky Mountains traverse the Territory in two north-south parallel ranges, having elevated level plains between them. The principal river is the Rio Grande del Norte, which flows southward to the Gulf of Mexico, having a total length of 1500 miles. It is almost entirely unnavigable from end to end, owing to its swift current, and the presence of numerous shoals and quicksands. A few other streams rise in the Territory and join either the Rio Colorado on the west, or the Arkansas on the north. The writer of the article speaks in enthusiastic terms of the genial and salubrious climate. He also gives interesting particulars of the characters, habits, and ways of life of the native Mexican and Indian population. Since this part of the United States has been rendered more accessible by the construction of the great Atchison, Topeka, and Sante Fé, and the Southern Pacific Railroads, with their dependent branches, New Mexico has begun to undergo a process of "Americanising."

NEW BOOKS.

The Origin of Mountain Ranges considered Experimentally, Structurally, Dynamically, and in relation to their Geological History. By T. MELLARD READE, C.E., F.G.S., etc. London : Taylor and Francis, 1886.

Among the problems with which physical geologists are wont to grapple, that of the origin and history of the great mountain landmarks of the earth is one of the most interesting and profound. Although observations and theories have been multiplied, much still remains to be done in this field of research, and Mr.

Mellard Reade deserves the thanks of all who are interested in terrestrial physics for the mass of valuable material he has brought forward in the volume now before us. His book forms a substantial contribution to the solution of the problem of mountain-building, and, if we cannot agree with all his conclusions, we cannot but welcome the mass of experimental evidence he has collected in their support. Since the days of Sir James Hall, experimental geology has been too much neglected in this country, and we have been far surpassed by foreigners in this branch of the stony science. Mr. Mellard Reade is an engineer, and discusses his subject in a practical common-sense way, which commends itself highly to our approval.

This volume is described as an attempt to provide a systematic treatise on the origin of mountain ranges and supports a theory which has not yet gained much acceptance in this country. Babbage, in 1834, pointed out that the addition of sediment would raise the temperature of the part of the earth's crust on which it was deposited. He and others who followed seem to have fixed their attention on the *linear* vertical expansion which the mass of newly heated strata would undergo, and to have forgotten that a rise of the isogeotherms would cause a lateral extension as well. The author, assuming that the earth is a solid spheroid, shows how mountain ranges are forced up by this cubical expansion, due to the rise of the isogeotherms, below great areas of sedimentation. From experiments on different rocks, the average coefficient of expansion is found to be $\frac{1}{100000}$ per 1° F., or 2.77 feet per mile for every 100° F. If the isogeotherm of 3000° F. (the fusing temperature of rock) were to rise from a depth of 35 to 25 miles, the temperature of the strata at 25 miles depth would be raised 857° (that of the surface remaining constant at say 50°). The mean increase for the whole 25 miles of crust would be thus $428^{\circ}.5$, and the mean expansion per cubic mile would be $\frac{1}{48}$ or 11.869 feet in each direction. If the area so affected measured 500×500 miles, the total expansion of a piece of the crust of this size and depth would amount to 42,230 cubic miles. This result is startling, but in no way extravagant, and the area considered is smaller than many of the areas of sedimentary rocks from which mountain ranges have been built.

At depths greater than 2 miles, the strata are compressed beyond their crushing-strain, by the weight of rock alone, and are ready to flow like cold lead through a die whenever there is a slight relief of pressure in any direction. It is thus impossible that empty cavities can exist below a certain depth of strata. "The tendency to expand horizontally is checked by the mass of the earth's crust bounding the locally-heated area," and hence the expanding mass must expend its energies within itself. Mountain ranges will be forced up along lines of weakness, and when once originated, will tend to become permanent outlets for the plastic expanding mass below. The sheet lead on an old roof or kitchen sink is usually seen to be covered with wrinkles. Each rise of temperature ridges up the metal along lines of weakness, but its tensile strength is too small to smooth the surface completely down again when the temperature falls, so that by continual alternations of temperature, the wrinkles grow by successive increments. The author has experimented both on sheet lead and on different kinds of rock, and shows how rock may by this process become permanently distorted. Hence he argues that mountain ranges are upheaved, not at once, but by a long continued series of expansive movements of the heated strata. The axes of the anticlinal wrinkles are the lines of least resistance, up which the compressed matter will be squeezed. It will take the form of cores of gneiss or schist such as occur abundantly in the Alps and other regions.

In Chap. xv. the writer attacks the theory that mountain ranges are formed by the contraction of the cooling interior, causing the surface of the earth to wrinkle like the skin of a dried apple. It has been usual to estimate the amount by which the surface has diminished, by measuring round the folds of the strata in crumpled districts, and so ascertaining the breadth of the area they originally covered. We think the assailant has reason on his side when he says, "The beds in such estimates are assumed to be of their original thickness, which I contend they are not; . . . no estimate of the length of a fold is any index of the original length of the bed before folding. Again, it is assumed that the denuded tops of the anticlinals were once continuous as arches spanning the respective areas. This again we have reason to suspect is not in all cases true." According to this method of computation, the areas on each side of the Alps have approached 72 miles nearer one another, and if all the foldings on the surface of the globe could be measured in this way, they would give a total superficial contraction of many hundreds of miles—a result totally opposed to the principles of physics and sound reason. To make his position good, however, the author should do more to prove that the great folds of the Alps and Appalachians are formed of strata actually drawn out to a deceptive length. This, it may be hoped, will be attempted in a second edition.

With upheaval and denudation the isogeotherms will begin to sink, and a corresponding shrinkage of the previously expanded area will ensue. This contraction, it is argued, is the cause of normal faulting, and hence all normal faults are to be regarded as downthrows. Another and more striking effect of the sinking of the isogeotherms, is, according to Chap. xxv., the phenomenon of earthquakes. Apart from volcanic centres, "the countries which are most subject to these dreadful tremors are precisely those in which there is a development of the later formations, and particularly the Tertiary." The earthquake of Lisbon, and the shock which devastated Georgia and South Carolina last August, were, for example, in regions of Tertiary age. In such areas, the isogeotherms are probably sinking, and the consequent contraction does not take place quietly, but by sudden snaps, accompanied sometimes by subsidence of the surface.

Volcanic action, the author maintains in Chap. xxi., is intimately associated with mountain-building. "It would seem," he says, "that for the production of mountain ranges, the volcanic forces must remain long sealed up, so that the heat, instead of being dissipated at the surface, may be distributed through the overlying rocks." But when the volcanic matter bursts out, there is a loss of potential energy which would otherwise be expended in mountain-building. In such cases, the lava will exude quietly, and form plateaux like that of the Deccan, without any great disturbance of the rocks below.

The volume is profusely illustrated with sketches, ink photos, and diagrams. The sketches, as a rule, have no great scientific or artistic value, and most of them might, with advantage to the purchaser, have been left out. We think the author could greatly curtail Chap. xvi., both in text and illustrations, without in any way lessening the value of a work in which there is a large and valuable fund of practical good sense and originality.

Geographisches Jahrbuch. Begründet 1886 durch E. BEHM. XI. Band, 1887. Unter Mitwirkung von O. Drude, etc., herausgegeben von Hermann Wagner. Gotha: Justus Perthes, 1887. Pp. viii., 496. Price 12 mark.

Of the various services rendered to Geography by Dr. Ernst Behm (who, after twenty-eight years' activity in the establishment of Justus Perthes, died at Gotha in 1884), none perhaps is of higher moment than the originating of the

Geographical Year-book in 1866. Since its first issue it has not only increased in magnitude and scope, but improved in method and scientific value. It practically consists of a sevenfold cluster of treatises, critical and bibliographical, each of which, if published apart, would be an admirable *vade mecum* for a separate class of specialists. Drs. Hergesell and Rudolph, of the Protestant Gymnasium at Strassburg, have combined to produce the elaborate report on the progress of "Geophysics," for which we have previously been indebted to Prof. K. Zöppritz; and they undertake in future also to supply the article on the European degree measurements. A most elaborate *résumé* of the progress of knowledge with regard to the geological structure of the several parts of the world is contributed by Professor Franz Toula of Vienna; a special article is devoted to "Oceanography" by Professor Krummel of Kiel; and Professors Oscar Drude of Dresden and L. K. Schmarda of Vienna respectively continue their digests of the great departments with which their names have so long been associated—the distribution of plants and the distribution of animals. The sketch of Ethnological research is again contributed by Dr. Gerland of Strassburg. The addition, for the first time, of an alphabetical list of authors' names at the close of each section is a distinct improvement.

La Tunisie: Par J. L. DE LANESSAN, Député de la Seine. Avec une carte. Paris: Félix Alcan, 1887. Pp. 268.

This work is marked by the same qualities of conscientious thoroughness and mastery of detail which characterised M. de Lanessan's larger book on French Colonial Expansion, reviewed at considerable length in the April number of this Magazine. The writer, after devoting one short chapter to the soil, climate, and population of Tunis, proceeds to the elaboration of his main theme, an exhaustive treatment of the agricultural, commercial, industrial, and financial condition of the country in question. He describes the chief occupations of the population, native and European, how they cultivate the soil, by what tenures they hold their several properties and possessions, what are the yield capacities of the various kinds of natural products—the cereals, olives, dates, alfa, forests, etc.—what are the conditions under which trade and commerce are carried on, what the imposts and dues that have to be paid; and concludes by suggesting a series of reforms touching the incidence of taxation, the tenure of landed property, customs dues, and public works. As for taxation, he complains that it bears very heavily upon those subject to it, and does not benefit the Governmental exchequer to the extent it ought to do, and might easily be made to do, by a readjustment of its incidence. It falls, he says, upon the products of the soil, and not, as it should, upon the soil itself. The chief wants of the French colonists in the shape of public works are bridges and railways, more especially the former. M. de Lanessan advocates the cultivation of the soil of Tunis by French emigrants, and his suggested land reforms are mainly directed to the consummation of that aim.

We are glad to notice that the map appended to the book shows a great improvement upon those which appeared with the author's larger work already mentioned.

Journals kept in Hyderabad, Kashmir, Sikkim, and Nepal. By Sir RICHARD TEMPLE, Bart., M.P., etc. Edited, with Introduction, by his Son. In Two Volumes. London: W. H. Allen, 1887.

Since his return from the Governorship of Bombay, after a most varied and brilliant Indian career, Sir R. Temple has added many works to Anglo-Indian literature, but none of greater value than this. He himself is an accomplished

traveller, administrator, and artist in water-colours, while his son, Captain R. C. Temple, stands high among Oriental ethnologists and antiquaries. The result is additions to our geographical and political knowledge, in our feudatory States, so little known to the general reader, and even to scientists, as the vast territory of Haidarabad in Central India, the western region of Kashmir, the little principality of Sikkim, and the interesting and, but for us, independent State of Nepal. New facts are recorded in the case of all. The maps and plans are full and accurate. The coloured illustrations are charming sketches of architecture and scenery. The political value of the Haidarabad Journals is great. We have noticed only one mistake, under Sikkim, where the Mahanadi is put for the Mahananda River (vol. ii. p. 181).

A Geography of the Malay Peninsula, Indo-China, the Eastern Archipelago, the Philippines, and New Guinea. By Professor A. H. KEANE, B.A., F.R.G.S. With a Map. London: Edward Stanford, 1887.

This little manual supplies, and supplies well, a want not met since, in 1856, our accomplished countryman, John Crawford, F.R.S., published his *Descriptive Dictionary of the Indian Islands and Adjacent Countries*. Since then, many a naturalist and explorer, like Wallace and Forbes, and missionaries, like Chalmers and Gill, have opened up unknown portions of Malaysia and the adjacent Oceania. Mr. Keane has made good use of all the recent materials and scientific conclusions of experts, and has produced a text-book which will call forth the gratitude not only of teacher and pupil, but of every student and traveller in the Straits Settlements. The book does for Further India and Oceania (including Burma) what Mr. John Murray's *Student's Geography of British India* does for our Eastern Empire. We have but one fault to find with it—Burma is not treated in sufficient detail for Indian students—district by district. A bibliography is not given, and the double paging of the contents hardly atones for the want of an index.

NEW MAPS.

(*Edited by Professor James Geikie, LL.D., F.R.S.*)

AFRICA.

AFRIKA—Spezial-karte von—, in Massstab von 1 : 4,000,000 (or 55·5 geographical miles to an inch). 10 Blätter. Entworfen von HERMANN HABENICHT, bearbeitet von demselben, BRUNO DOMANN und Dr. RICHARD LÜDDECKE. Zweite vollständig neubearbeitete Lieferungs-Ausgabe. I. Lieferung. Inhalt: Sektion 6 (Abessinien), Sektion 7 (Congo).

Gotha: Justus Perthes. Price, M. 18.

It is only a very short time since the last part of the first edition of this standard map was issued; and we are glad to welcome already a second edition, which has been thoroughly revised and brought up to date.

As stated in the preface, the necessary alterations, arising from new discoveries and improved surveys, were so numerous and important, that many of the sheets have been practically re-drawn; and the map has also been supplemented with special enlargements of the neighbouring islands.

The sheets issued in the first part are Abyssinia (6), and Congo (7). On the Abyssinian sheet the alterations are not very important; but we note that the important results of Dr. Junker's last journey are laid down, as are also Cechi and Chiarini's routes from Zeila to Ankober, the limits of Emin Pasha's province

and those of the new territory claimed by the Italians, between Massowah and Raheita.

The Congo sheet is almost a new map, as there were more alterations to make on this region than on any other part of Africa. We find here incorporated, since the last edition, the recent explorations of Capello and Ivens; the discoveries of Reichard and Böhm, between Tanganyika and the Lualaba; the results of the exploring expeditions of von François, Kund, Tappenbeck, Wolf, and Büttner, in the southern parts of the Congo basin; the river surveys of Grenfell and von François on the Central Congo; Rouvier's new surveys of the French possessions; and even the new routes of De Brazza and Giacomo have been added before going to press.

The printing of both sheets is very much clearer than in the last edition, and the hand-colouring is also a great improvement.

SUAKIN AND KASSALA—Die Karawanenstrassen zwischen—. Nach Itineraraufnahmen von Josef Menges, gezeichnet von C. Barich. Massstab, 1 : 800,000. *Petermann's Mitteilungen, Jahrgang 1887, Tafel 6. Gotha: Justus Perthes.*

ASIA.

JAPAN—Tektonische Karte von Japan.

Geologische Karte von Japan.

Von Dr. E. NAUMANN. Massstab, 1 : 5,760, 000.

Wien. Mitt. der Kais. Kön.-Geogr. Gesell. Band xxx., Tafel, iv., v.

TIBET, illustrating the journeys of Colonel Prejevalsky. Scale 1 : 5,800,000.

Proceedings of the Royal Geographical Society, May 1887.

This map is a valuable contribution to the geography of Tibet.

AMERICA.

ALASKA, Southern Part.—Illustrating the paper of Lieutenant H. W. Seton-Karr. Scale 1 : 2,900,000.

Proceedings of the Royal Geographical Society, May 1887.

BRAZILIEN UND VENEZUELA—Karte der neu bestimmten Grenze zwischen Brasilien und Venezuela, nach den Aufnahmen der brasilianischen Grenzcommission. Massstab, 1 : 2,000,000.

Berlin: Zeitschrift der Gesellschaft für Erdkunde, Band xxii., Tafel 1.

MEXICO.—Uebersicht der Höhenverhältnisse und der Eisenbahnen, von A. SCOBEL. Massstab, 1 : 15,000,000.

Bremen: Deutsche Geographische Blätter, Band x., Tafel 1.

NIKARAGUA-KANALS—Spezial-karte des —. Nach der Karte der Verⁿ. St^a. Vermessungs-Expedition unter A. G. Menocal, U.S.N., 1885. Massstab, 1 : 600,000.

Petermann's Mitteilungen, Jahrgang 1887, Tafel 8. Gotha: Justus Perthes.

VANCOUVER ISLAND—Die Indianerstämme von Vancouver Island und an der Küste von Britisch-Kolumbia. Nach eigenen Forschungen gezeichnet von Dr. Franz Boas. Massstab, 1 : 2,000,000.

Petermann's Mitteilungen, Jahrgang 1887, Tafel 7. Gotha: Justus Perthes.

GENERAL.

BURGHHAUS' PHYSIKALISCHER ATLAS.—Neunte Lieferung. Inhalt: No. 38, Regenkarte der Erde (W. KOPPEN); Nr. 50, Florenkarte von Amerika (Dr. O. DRUDE); Nr. 60, Haustiere und Parasiten (Dr. W. MARSHALL).

Gotha: Justus Perthes, 1887. Preis M. 3.

ERDPROFIL der Zone von 31° bis 65° N. Br. im Massverhältniss 1 : 1,000,000, von FERDINAND LINGG, Kgl. Bayer. Ingenieur-Hauptmann, A.D.

München: K. B. Priv. Kunstanstalt von Piloty u. Loehle. Preis M. 20.

This is a beautiful piece of work, which must claim the study and admiration of all geographers as something quite new among the many attempts to illustrate the relief of the earth's surface. It may be briefly described as a section-map of the earth's surface between the parallels of 31° and 65° north latitude. The arc of the sphere between these parallels is shown in its true proportions, one million times reduced, or about 13·4 geogr. miles to an inch, so that the whole arc, as here shown, is fourteen feet long. The principal section, which is coloured brown, is along a line across Europe, extending from Tripoli to Trondjhem, and shows, in profile, the elevations of the mountains and plains, and the depressions of the seas, on their true vertical scale in proportion to the size of the sphere. Behind the brown-coloured European profile the high peaks of North America, in the corresponding latitudes, are shown in purple colour; and behind them again rise the great plateaux and peaks in the corresponding latitudes in Asia. The first impression that an inspection of the whole profile conveys, is the very slight elevation of even the highest mountains in proportion to the immensity of the sphere, so that they may be compared to the merest pimples on its surface. The scarcely perceptible elevation of our Grampian Hills is in striking contrast with the great mountain-masses of Asia.

Herr Lingg must be congratulated upon the thorough and artistic manner in which he has executed his work. We trust it will soon be adapted for school use, for it teaches more Physical Geography at a glance than can be otherwise learned in many days.

NEW COMPLETE ATLAS of the World, by G. W. BACON, F.R.G.S., containing all the latest Geographical Discoveries throughout the various countries of the World, with General Descriptions, Index, etc.

London: G. W. Bacon and Co. Price, £2, 15s.

Had Mr. G. W. Bacon announced that he was bringing out a new edition of the old "Weekly Despatch Atlas," we should have been disposed to allow that he had done fairly well in trying to bring the information on these old maps up to date. But by widely advertising that he has just completed an atlas which he claims to be "the most modern, accurate, and comprehensive in existence," we feel bound, in the interests of the geographical public, to say that his statements are entirely misleading. It is true that these old maps of the "Despatch Atlas" have been partly revised, and that one or two new maps have been added; but it is a case of "putting new cloth into old garments," and only occasions glaring inconsistencies.

There are such things as "shoddy atlases," and the only distinction we can give to Bacon's Atlas is, that of this class it is the largest and most complete at present published.

PHILIPS' Handy Volume Atlas of the World, with Index and Statistical Notes, containing 64 plates. *London: George Philip and Son. Price, 3s. 6d.*

This little atlas, constructed on the same lines as Bartholomew's Pocket Atlas, contains no noteworthy new features, if we may except the neatness of its binding.

The collection of maps, judging from their inconsistencies, bears evidence of somewhat hurried preparation. For instance, there are no railways shown in any of the maps of European countries; while on such maps as Central Asia and Further India we have them prominently depicted.

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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

J A P A N.

BY RUSSELL ROBERTSON, H.B.M. CONSUL AT YOKOHAMA.

(Read before the Society, April 1887.)

THE word *Japan* is perhaps a somewhat ambitious title for this paper as, naturally, it is impossible to compress into half an hour's reading all that one could say of that country. I have thought it better, however, to use this one comprehensive word, as it leaves me free range for my subject, and will enable me to touch on matters which, if not perhaps coming quite within the scope of a Geographical paper, will doubtless be equally of interest as if these sheets treated simply of the physical geography of Japan.

There are possibly amongst my audience here to-night some who have visited Japan ; but I doubt if there is one who has resided there, as I have, for upwards of twenty-five years. I do not, however, wish to dwell on this fact of lengthened residence as giving me exceptional claims to write or speak with particular authority. I fully recognise that visitors who spend a few months in Japan, who have good powers of observation, and who use those powers, may commit to paper an excellent picture of what they see, and a good account of what they hear ; but there is frequently a tendency with such writers to impart a high local colouring to their word-pictures, and to regard in too enthusiastic and too poetic a light what is really somewhat dry prose to the permanent resident. Japan has, perhaps, suffered more than any other country from being painted in too bright colours by travellers, with the result that those who come after them have experienced some disappointment on finding that everything did not come up to the expectations they had permitted themselves to form.

My object in this paper will be, so far as circumstances admit, to present to you a truthful picture, neither coloured with romance on the one hand, nor on the other darkened with too sombre views.

In the first place, I will ask your attention for a few moments to consider what the word "Japan" is. The Japanese do not call their country by that name, any more than the Germans speak of their country as Germany, or the Belgians of Belgium. The word *Japan* is obtained in the following manner. As you may readily understand, our knowledge of China dates from a period anterior to the time of our knowing much of Japan, but to China herself Japan has for centuries been no *terra incognita* in the sense she has been to us. To the Chinese "Japan" is known as "Ji pun," words signifying "origin of day;" the same characters or ideographs mean in Japanese "Nichi" "Hon," contracted into "Nipon," or "Nippon." We have been long familiarised with the "Jipun" of the Chinese, and it will be readily conceived how the "Jipun" slipped into the "Japan" of the present daily use. From the meaning of the ideographs "origin of day," we obtain that appellation of Japan which is so familiar to our ears, "the Land of the Rising Sun," or, in other words, the "Land of the Origin of Day." You are, of course, aware that the national flag of Japan is a red ball on a white ground—in fact, the full and brilliant sun orb. A singular error prevails in attaching the name "Nippon" to the large main island of the group, whereas the word is applied to the whole empire, which consists of the four main islands, the Kuriles, the Riukiu group, Iki, Tsushima, the Oki group, and many other islands and islets.

One of the principal features in connection with Japan, that I am anxious you should be acquainted with, is the conditions under which foreigners live in that country; and by foreigners I mean English, French, Germans, Americans, and in fact members of all other nationalities than the Japanese. There seems to be here a very general, and, I admit, a pardonable ignorance of those conditions which a few words will suffice to explain. Japan is, as you know, opened to trade with foreign countries, but still only in a limited sense; as, for commercial purposes, all foreigners are compelled to reside at the ports of Yokohama, Hiogo or Kobe as it is equally styled, Ozaka, Nagasaki, Hakodate, Niigata, and the city of Tokyo, formerly called Yedo, excepting those foreigners employed in the interior, in the service of the Government of Japan. In order not to overburden your minds with names, that in some cases must necessarily be strange to your ears, you may dismiss that of Niigata in connection with the open ports, as it has been found to be comparatively valueless for purposes of foreign trade, due principally to its exposed situation, and its inconvenient, if not indeed dangerous, anchorage. It lies on the west coast, and knowing thus much about it, it need give you no further concern. In order the better to appreciate the situation and the conditions of our residence in Japan, you should know that foreigners are only there by virtue of express treaties with the different foreign Powers; and the

countries that have concluded such treaties are England, France, the United States, Germany, Austria-Hungary, Russia, Holland, Spain, Portugal, Sweden and Norway, Italy, Switzerland, Denmark, Peru, China, Hawaii, and Corea. I have not named them in any particular order or sequence, and it is sufficient to note that the treaties which govern our residence there now mostly date from 1858, and subsequently. Treaties existed with different countries before that date, notably that with the United States, of 1856 ; but I am referring more particularly to the actual conditions of trade and residence which now exist, and which may be said to date from 1858, although some of the ports I have named were not thrown open to our commerce until a few years later. The treaties of 1858 were not ratified until 1859, so that the history of recent Japanese progress, more particularly as affected by foreign intercourse, dates really only from that time. I am not going to inflict on you a historical paper—far from it ; but it is essential to an intelligent understanding of our position in Japan, to glance briefly at these few points. The treaties provide, not only that commerce and residence shall be restricted to the places I have mentioned, but further, that the particular location of foreigners within most of those places or ports should be accurately defined. These locations are called “settlements,” and therefore one of the first things that strikes on the ear of the visitor arriving at Yokohama, Tokyo, Hiogo, or Osaka, as the case may be, is this word “settlement” or “concession,” as it is sometimes termed, as applied to the particular locality where foreigners reside, and as distinct from the Japanese quarter of the town. At some of the ports these settlements have particular appellations, as for instance at Tokyo, where it is known as “Tskiji,” or “made ground,” the ground having been actually filled in, drained, and laid out for the purposes of foreign residence. These settlements are divided into lots, differing in area, and on these the foreigner, having first acquired his lot by purchase, and having stipulated to pay a somewhat heavy annual ground-rent, erects his dwelling, his office, and his warehouses. These strict conditions of residence have been considerably relaxed as years have passed, and more enlightened views have obtained ; lots of land for suburban or country residences were sooner or later acquired in the neighbourhood of the settlements, and thus pleasant little country dwellings have sprung up, which have considerably enhanced the pleasures of a residence in Japan. I should mention, too, that these same treaties I have referred to all stipulated that foreigners should not travel beyond certain limits from the settlements, these limits being generally fixed at from 25 to 30 miles, so that, as you can well understand, for some years the interior of Japan was very little known to us ; but this exclusive state of things has long since yielded to a system of passports, that are now easily obtained, and by means of which the holder can travel from one part of the empire to the other.

There is a phrase that I find frequently puzzles English ears, and it is natural that it should be somewhat unintelligible to those who are

unacquainted with it. I refer to the words "ex-territorial jurisdiction." There is nothing, however, in them to frighten or puzzle the meanest capacity; they signify simply that in certain countries, where this form of jurisdiction obtains, foreigners in those countries are subject, not to the laws of those particular countries, but to their own laws administered through their own consular tribunals. The system prevails in a greater or less degree in Turkey, Egypt, China, Japan, and Siam. I will not particularise, but you can well understand that in some of the countries I have mentioned it would not be consistent with our ideas to submit to the system of law that might be administered by the native tribunals; decapitation might be the penalty for a comparatively light crime, not to mention torture as a mode of extracting confessions of guilt. It is only fair to mention that, in the case of Japan, torture has now no place in her criminal code or procedure. It has followed, therefore, that in the treaties with Japan, negotiated on the lines of treaties concluded with China and other of the countries I have named, it has been stipulated that foreigners are to be tried by their own consular or judicial authorities both in respect of civil and criminal actions. A Japanese having reason to complain of a British subject would have to sue him before a British court in Japan; whereas the British subject would in the converse case have to appear as plaintiff in the Japanese court, before which the Japanese subject would appear as defendant.

You will now understand that, with something like seventeen different countries with which Japan has treaties, you have the same number of consular tribunals, and that accordingly, as a Japanese may be aggrieved by an Englishman, Frenchman, German, or American, as the case may be, so will he appeal to the consul of one or other of those countries for relief.

This is briefly the ex-territorial jurisdiction—a state of things which bristles with many difficulties, but which appears to be the system best adapted for the protection of Europeans in countries where the judicial system is one that they could not well be made to submit to. Japan has, however, made such strides in judicial reform that before many years are passed it is possible—nay, probable—that the ex-territorial jurisdiction will be done away with in that country, and that we shall be residing there under Japanese law, which will, it is to be hoped, entail no more risk than does a residence in many European countries.

GEOGRAPHY.—I now pass to the geographical features of Japan. The earliest division of the country into provinces was made between 131 and 190 A.D., their number being thirty-two.

In the third century, after Japan had been victorious in Corea, and in imitation of the geographical division in that country, it was marked out into seven circuits, and what were styled five home provinces. Subsequently, about the beginning of the eighth century, some of the provinces were subdivided, the number being increased to sixty-six, which

I proceed to name. Taking first the five home provinces, comprised under the name "Gokinai," we have Yamashiro, Yamato, Kawachi, Idzumi, and Setsu. Then taking the circuits, we have the "Tokaido," or "Eastern Sea Circuit," in which are contained the following fifteen provinces:—Iga, Ise, Shima, Owari, Mikawa, Totomi, Suruga, Idzu, Kai Sagami, Musashi, Awa, Kadzusa, Shimōsa, and Hitachi.

Then the "Tozando," or "Eastern Mountain Circuit," comprising eight provinces:—Omi, Mino, Hida, Shinano, Kodzuke, Shimotsuke, Mutsu, and Dewa.

The "Hokurikudo," or "Northern Land Circuit," with seven provinces:—Wasaka, Echizen, Kaga, Noto, Etchui, Echigo, and the island of Sado.

The "Sanindo," or "Mountain Back Circuit," containing eight provinces:—Tamba, Tango, Tajima, Inaba, Hoki, Idzumo, Iwami, and the Oki group of islands.

The "Sanyodo," or "Mountain Front Circuit," having also eight provinces:—Harima, Mimasaka, Bizen, Bichiu, Bingo, Aki, Suwo, and Nagato.

The "Nankaido," or "Southern Sea Circuit," comprising six provinces, namely Ki-i, Awaji, Awa, Sanuki, Iyo, and Tosa.

I would ask your attention here to the province of Ki-i, or Kishiu, as it is more familiarly called, in order that it may not be confounded with the large island of Kiushiu. To the uninitiated ear the similarity of sound between Kishiu and Kiushiu tends to great confusion. Kishiu is simply one province of the Nan-kai-do circuit, whereas Kiushiu means really the "nine provinces," and is co-extensive with the last of the circuits, the "Sai-kai-do," or "Western Sea Circuit," which is divided into nine provinces, namely, Chikuzen, Chikugo, Buzen, Bungo, Hizen, Higo, Hiuga, Osumi, and Satsuma. The islands of Iki and Tsushima, dealt with as separate provinces, would, with the sixty-six provinces already named, making in all sixty-eight, complete the geographical divisions of Japan which existed from comparatively remote times until a recent date. This division of the country continued until 1868, when, as the result in great part of the revolution which marked that year, the northern island of Yezo was constituted a circuit under the name of the "Hokkaido," or "Northern Sea Circuit," comprising the eleven provinces of Oshima, Shiribeshi, Ishikari, Teshiwo, Kitami, Ifuri, Hitaka, Tokachi, Kushiro, Nemuro, and Chijima, the last named being that portion of the Kuriles then belonging to Japan. Since that date the whole of the Kuriles have passed into the possession of Japan by arrangement with Russia, to which country the exclusive possession of Saghalien was surrendered—the southern half of that island having been previously claimed by Japan. In 1868 there was, in addition to the Hokkaido just mentioned, a subdivision of the two large provinces of Oshiu and Dewa, the former into the provinces of Iwaki, Iwashiro, Rikuzen, Rikuchiu, and Michinoku; the latter into Uzen and Ugo.

In order to a thorough comprehension of the geographical divisions of

Japan, it is essential to bear in mind that in early times, when the country was divided into thirty-two provinces, the authority of the Mikado or Emperor of Japan was bounded on the north by a line which might be drawn from the Bay of Sendai on the east to Niigata on the west, the northern portion of the main island as well as the island of Yezo being then occupied by barbarous tribes, the descendants of which may be traced in the Ainos now settled in Yezo. It should also be remembered that the territories of the Lord or Daimio of Matsmae in Yezo were at one time included in the northern provinces of Dewa and Mutsu, but this division no longer exists, the northern island and adjacent Kuriles having, as already mentioned, been divided into eleven provinces. This island of Yezo has of late years been treated in the matter of administration as a colonial dependency of the empire, a special department or bureau existing at Tokyo, the capital of Japan, which is charged with the affairs of Yezo. The island is interesting not only by reason of the aborigines, the Ainos, that inhabit it, but because laudable agricultural experiments have been carried on there at the expense of the Japanese Government, and great and successful endeavours have been made to acclimatise foreign fruits. Valuable coal deposits have also been discovered on the island, and magnificent fisheries exist in its waters. I have myself lived in Yezo for two years, and although I have never visited Vancouver in British Columbia, I can well believe what is currently reported, that Yezo resembles it in many respects in regard to scenery and conditions of climate and soil.

In 1872 we find Japan divided for purely administrative purposes into three *fu*, or cities—namely, Kyoto, Tokyo, and Ozaka, and into seventy-two *ken* or prefectures; and this without necessarily following the boundaries of provinces. Since that date—1872—the prefectures have been recast and brought down to thirty-seven in number. To complete this particular portion of the paper, I should state that the Riukiu group of islands, generally called by foreigners the Loochoos, was constituted a prefecture of Japan in 1878, under the name of the Okinawa Ken; the so-called King of Loochoo then losing his sovereignty, and taking a position amongst the nobility of Japan. This full assertion by Japan over the Loochoos was not without its troublous side, in consequence of China's claim of suzerainty over the islands, and it is still from time to time the subject of some little friction between the two Powers.

The Bonins, or Ogasawara Islands, as they are termed by the Japanese, and over which Japan now exercises complete sovereignty, are deserving of mention; they consist of two main islands separated by 50 miles of sea, and of several smaller islands and islets. The whole group is situated about 500 miles due south from Yokohama. It is interesting to remember that these islands were, so far as the unsupported act of an English naval officer could make them so, the property of Great Britain; for in 1824 Captain Beechey of H.M.S. *Blossom* visited them, and took formal possession in the name of His Majesty King George IV. A copper

plate, affixed to a board which had been nailed to a tree, recorded the fact; and I may mention that this board was found in 1875, when I visited the islands, and is now, I believe, to be seen at Greenwich College. It is perhaps needless to say that the British Government never gave effect to Captain Beechey's act; and in 1875, in consequence of the island having become the scene of some crimes, owing to quarrels amongst the settlers, the Japanese Government was moved to occupy the islands, and establish in them the machinery of government. They are now an integral part of the empire, regular communication being kept up by steamer from Yokohama and Tokyo.

The population of the islands consists not solely of Japanese, but, in addition, of a few Sandwich Islanders and others who have been left behind, or have deserted from the whalers that used to touch at the group. At the time of my visit, an Englishman, Webb by name, resided on the islands, and was regarded as the patriarch of the curious mixed settlement of foreigners. It is now some years since he died.

I was reading, some time ago, an old volume of correspondence between the East India Company's factor at Canton and the directors in London, and in the course of the correspondence I came across a letter dated, I think, in 1830, strongly urging that the British Government should occupy the Bonins as an important base of trade. As a fact, there is very little trade even now between them and the mainland of Japan, the soil barely supporting the small colony established there.

To revert to my subject, I shall be glad to clear the ground of all sources of confusion in respect of the names of the different provinces I have given. They mostly have two names, one of Japanese derivation, the other Chinese, made up of the word "shiu," a province, and the Chinese pronunciation of one of the ideographs with which the purely Japanese name is written. I have not mentioned these in the body of my paper, so as to avoid perplexity; but I can illustrate my meaning by the following examples. Take, for instance, the Gokinai, or five home provinces, which, as I have stated, are Yamashiro, Yamato, Kawachi, Idzumi, and Setsu. Each of these has an alternative appellation derived from the Chinese, as, for example, Yamashiro is called Joshui; Yamato, Washui; Kawachi, Kashui; Idzumi, Senshui; and Setsu, Sesshui; it being essential you should bear in mind that "shui," which you hear so often repeated, is the Chinese word for "province," and the monosyllable prefixed, such as Jo-, Wa-, Ka-, and Sen-, is simply the Chinese pronunciation of one of the Japanese characters with which the purely Japanese word is written. What makes the subject a little more complex is that the Japanese, in some cases, use the one appellation, and in some cases the other. Thus, for instance, still keeping to the five provinces I have named as furnishing an illustration, while the names Yamashiro, Yamato, Kawachi, and Setsu, being Japanese words, are in more frequent use than their Chinese equivalents of Joshui, Washui, Kashui, and Sesshui, in one case, that of Idzumi, the Chinese equivalent of Senshui is much more popular.

Mention should not be omitted of a somewhat quaint division of Japan that at one time existed into the country lying "east of the barrier" and that lying "west of the barrier," called respectively "Kwantô" and "Kwansei," the barrier being taken to mean the old barrier of Ozaka, on the frontier of the provinces of Omi and Yamashiro; and the peculiar appellation I have above noted being given to the provinces lying east and west of this boundary. The term Kwantô is now, however, applied to eight, or at most twelve provinces only, instead of to thirty-six as formerly.

ISLANDS.—I will now glance rapidly at the islands, rivers, mountains, harbours, bays, and straits in Japan. Commencing with the islands, it will perhaps surprise you to learn that these number over 3000, exclusive of the four main islands; many are, of course, but the merest islets. I would first ask your attention to the chain of islands that extends due south from my own port of residence, Yokohama, consisting of Oshima or Vries Island, Rishima, Ni-i-jima, Shikini-jima, Kantsu-jima, Miyaki-jima, and Mikura-jima. Oshima is usually sighted by vessels making for the Bay of Yedo, and is conspicuous by its active volcano. South of this chain of islands is the island of Hachijô, at one time, if not still, used as a penal settlement, and then, some 350 miles further south, lie the Bonins already mentioned. Another island, also named Oshima, lies close to the province of Kishiu. The neighbourhood of this island has been the scene of many shipping disasters, owing to the peculiar indraft of the current. An excellent light is exhibited at Oshima for the convenience of shipping. North of this is the large island of Awaji. A prominent group of islands is that to the south of Kiushiu, which, beginning with Tanegashima, takes in the Riukiu group, and ends with Haterushima. To the westward of the province of Satsuma we have the Koshigi-jima, and north of these the islands of Amakusa and Togi. Following north, we have the island of Hirado, so frequently spelt on English maps as Firando; this island is specially noteworthy as being the seat of the first English factory in Japan, founded in 1613, and mentioned in Will Adams' letters from Japan. The Goto group, to the westward of the treaty port of Nagasaki, should also be mentioned, and then we have the islands of Tsushima and Iki, constituting each a separate province. Following along the coast-line of the Sanindo, we have the Oki group of islands, forming the province of Oki, and to the north and eastward of these the large island of Sado.

A glance at any chart of the Inland Sea, the name popularly applied to the waters that lie between the Straits of Akashi and those of Shimonoseki, will show numberless islands or islets. The beauties of the Inland Sea have been described in no measured terms by tourists, and although the language used is sometimes too glowing, there are perhaps not many lovelier scenes than those to be witnessed in the day's journey that lies between Hiogo and Shimonoseki. Mention has already been made of

the Riukiu group, and it now only remains to note the Kuriles, all belonging to Japan.

RIVERS.—There are no rivers in Japan that attain to great length, a circumstance which may in great measure be explained, so far as the mainland is concerned, by its comparative narrowness, and even the more important would not be navigable throughout their length for other than boats of very light draught. They, of course, play their part in the transmission of produce, but their agency in this direction must in great degree yield to the more active one of railways, the construction of which is now being actively prosecuted in Japan. The principal rivers are the Tonegawa, the Shinanogawa, Kisogawa, Oigawa, Fujigawa, Tenriugawa, Sakatagawa, Abukumagawa, and the Ishikari. The Yodogawa, on which the town of Ozaka is situated, and the Sumidagawa, which passes through the capital of Tokyo, may also be noticed. The Tonegawa is the longest river, and has a length of about 172 miles. I may here remark that many of the Japanese rivers change their names in their course, but to state these changes in detail would only be to burden you unnecessarily with names. I will content myself with giving the sources of the rivers I have mentioned, and their course. The Tonegawa rises in the province of Kôdzuke, passes close to Maebashi, a town familiar as one of the principal emporiums of the silk trade in the centre of a rich silk district, here it distributes itself in a network of streams, uniting again close to where the Karasugawa is met; lower down, the river separates into two branches, the southern branch falling into the Bay of Yedo, at Horiye, the main stream continuing its course, receiving the waters of two rivers, and falling into the sea at Chôshi, on the Pacific coast. The Shinanogawa, a name not difficult to remember, as we are already familiar with the province of Shinano, rises in that province, flows first in a north-westerly and then in a northerly direction, passes through the province of Echigo in a north-easterly course, and meets the sea at Niigata. The Kisogawa also has its source in Shinano, traverses the provinces of Mino and Owari, in which latter it throws off several branches, and thence passes to the sea. The Tenriugawa, also rising in Shinano, flows into the province of Totomi, and thence to the sea. The Oigawa takes its rise in the province of Kai, and also passes through Totomi to the sea. The Fujikawa rises in the same province Kai, and thence flows through Suruga. The Sakatagawa has its origin in the north, between Uzen and Rikuzen, flows due west, and falls into the Japan Sea at Sakata. The Abukumagawa rises in Iwaki, constituting in its course the boundary between that province and Rikuzen, and flows into the Pacific Ocean. Heavy floods frequently occur in Japan, the rivers at certain seasons flow with great rapidity, and the strength of the currents has much taxed the ingenuity of bridge-builders, both native and foreign. A peculiar feature on the railway between Hiogo and Ozaka is the tunnelling of the river-beds, which are in some cases higher than the surrounding level country.

LAKES.—The principal lake in Japan is that of Biwa, in the province of Omi. It is some 50 miles in length, with an extreme breadth of 20. It is familiar to most visitors to Japan, owing to its proximity to Kyoto, the ancient capital of the Mikado, a city that few tourists miss. According to an old Japanese legend, Lake Biwa was the result of an earthquake in 286 B.C., when the lake was formed, and simultaneously the celebrated mountain of Fuji was called into existence. The other lakes are those of Hakone, from which the mountain of Fuji is easily accessible; Lake Suwa, in Shinano; Lake Chiuzeji, in the neighbourhood of Nikko; and Lake Inawashiro, in Iwashiro.

MOUNTAINS.—Japan may be described as a mountainous country, marked here and there by large alluvial plains and table-lands. The principal mountain is Fujisan, situated some 60 miles from Yokohama, on the boundary-line of three provinces, Kai, Suruga, and Sagami, and is visible from no less than thirteen provinces of the empire. Its height has been variously estimated, but may be set down with fair accuracy at 12,500 feet. It is an object of great veneration to Japanese, pilgrimages being made to it, and it commands the admiration of all by its singularly beautiful formation, rising as it does to a most perfect cone, and moreover being situated amongst very lovely scenery. The ascent is made without much difficulty, the best time for the undertaking being in July and August, though snow is met with even then. The cone is an extinct crater; the last eruption is recorded as having taken place in 1707, the ashes falling as far as the capital Tokyo, 70 miles distant. The Japanese still believe in its latent active qualities, and even as recently as last year some considerable alarm was excited in the minds of Japanese in my own neighbourhood by the exceptionally early and rapid clearing of the snow from the mountain summits, which they attributed to excessive heat from within, portending eruption. Nothing of the kind, however, took place. The mountains that take rank next after Fujisan are Gassan, in the province of Uzen; Mitake and Asamayama, in Shinano; the Nikko range in Shimotsuke, the highest peak of which, Nantaizan, is 7850 feet; Omine, in Yamato; Hakusan, in Kaga; Tateyama, in Echū; Kirishimayama, in Hiuga; Asosan, in Higo; Tsukubasan, in Hitachi, 5000 feet; Onsengatake, in Hizen, 4100 feet; Chōkaizan, in Ugo; and Iwakisan, in Michinoku. Asamayama, 8500 feet, a violent eruption of which took place in 1783, and Asosan are amongst the best known volcanoes.

HARBOURS.—Japan possesses many harbours affording excellent shelter to the numerous small craft that ply in Japanese waters. The best known to foreigners are those which exist in the treaty ports of Yokohama, Hiogo, Nagasaki, and Hakodate. At Niigata the anchorage, as already mentioned, is indifferent, and that at Ozaka is somewhat exposed. Other harbours little less known than those at the treaty ports, and either presenting natural advantages, or capable of being converted into safe and

convenient anchorages by a judicious outlay of money, are Oginohama, on the east coast ; Shimoda, near the entrance to Yedo Bay ; Toba and Matoya, in the province of Shima ; Mitarai, in the Inland Sea ; Takamatsu, in the north of Shikoku ; Kagoshima, in Satsuma ; Matsumae, in Yezo ; and not a few others. While on the subject of harbours, I may mention that Japan has an excellent lighthouse system, and the danger of navigation round its coasts is thus considerably minimised. In addition to lighthouses, all well-known submarine dangers are buoyed or marked with beacons. Regular visits are made by the Japanese lighthouse tender to the different lighthouses, buoys, and beacons, and the service is well and efficiently maintained.

BAYS AND STRAITS.—The best known are those of Yedo, Sendai on the east coast, the Bay of Ozaka, Owari Bay, and the Bay of Kagoshima ; and under the heading of straits, if I name those of Tsugaru, separating the main island from Yezo, Shimonoseki, at the western entrance of the Inland Sea, Idzumi and Okashi at the eastern entrance, I have named those most deserving of notice.

CLIMATE.—A few words on the climate of Japan. I find it difficult to make friends at home understand that Japan is not a country where tropical heat prevails. A glance at the map, showing that the islands trend from north to south, and that they are comprised within 24° and 50° 40' north latitude, is sufficient to convey the knowledge that Japan enjoys much diversity of climate, the temperature ranging from an almost Arctic clime in the north to something approaching a tropical one in the extreme south. In the island of Yezo, where, as already stated, I have passed two years, winter comes upon us in October, and continues to April. The season is marked by heavy snowstorms and somewhat severe frosts ; the harbour is, however, generally free from ice, and is open to vessels all the year round. The spring and early summer are genial and pleasant, but the close of July and the month of August are sometimes marked by a high range of temperature. In Yokohama the winters are bright, but cold, the temperature being frequently as low as that experienced in an English winter, though with a brighter sky, and the abundance of ever-green foliage saves us from that severe wintry aspect that marks our own climes. Throughout October, November, December, and January, the season gradually passes from autumn coolness to winter cold, and the months are pleasant enough. February brings with it much the same weather as here—cold winds, snow, sleet, and the usual signs of the break-up of winter. Spring comes upon us earlier than here, and throughout April, May, and June we are led by degrees to full summer.

Excessive heat is rarely experienced before July, but from that month till the close of September we are subjected to a very high range, the thermometer for days together standing at 95° and upwards, within doors, in the shadiest corner of a room. In September we are usually visited

with an annual typhoon or cyclone, and, when this has burst over us, we pass suddenly from summer to cool autumn.

In Nagasaki, the most southern port where foreigners reside, the summer heat is of longer duration than with us at Yokohama, and the winters, though cool and pleasant, are marked by considerably less cold weather. My remarks as to Yokohama would apply equally to Tokyo, the capital, from which we are separated by only 18 miles of rail; while at Hiogo, about 350 miles distant, the conditions of climate do not appreciably differ, except that, owing to its sandy soil, it enjoys a somewhat better reputation for general healthiness than Tokyo, Yokohama, or Nagasaki.

A better illustration of the extremes of temperature in Japan is afforded by the Kuriles in the north, and the Riukiu and Bonin groups of islands in the south. In the first mentioned you have an Arctic winter, while in the latter you have nothing approaching to cold weather.

In most of the ports in Japan where foreigners reside, very sudden changes of temperature occur in the twenty-four hours, thus causing a good deal of sickness.

EARTHQUAKES.—This paper would not be complete without mention of the earthquakes that are of such frequent occurrence in Japan. We are fortunate in having in that country Professor Milne, who has made a special study of seismology, and than whom there probably does not exist a better authority on that particular subject. It is a curious circumstance that while earthquakes are of frequent occurrence in Yezo and on the east coast of the main island, they gradually lose in intensity to the southward and westward of Yokohama, while on the west coast of Japan they are either unknown or exceptionally rare. The information that has been collected, after years of patient research, under Professor Milne's directions, have resulted, I believe, in establishing the fact that, so far as Japan is concerned, the two great earthquake centres which affect that country are to be found, the one in the north, in the bed of the Pacific to the east of the island of Yezo, the other in the Bay of Yedo, in close proximity to the capital Tokyo and the port of Yokohama. I am happy to say that during my term of residence, although earthquake shocks have been numerous, and some of alarming intensity, no great destruction of life or property has followed; but that disastrous earthquakes have occurred in Japan is evidenced from the fact that in 1855 nearly 15,000 houses were overthrown in Tokyo, and with accompanying very great loss of life; the latter, however, being due to the conflagration that ensued rather than to falling houses or other attendant dangers. The dwellings, being constructed for the most part of wood, are very inflammable; and the system of open charcoal braziers, then and still so much in use in Japanese houses, would explain the rapidity with which the conflagration spread. Earthquakes, so far as Yokohama is concerned, are believed to be more prevalent in May and in early autumn; it is within my own recollection, in

May 1870, that in one day no less than seventeen shocks were experienced, culminating at midnight in one of great violence. Many out of these seventeen were of course of very slight character, but yet distinctly perceptible.

The Japanese chronicle certain years as having been marked by very violent earthquakes—namely, A.D. 416, 599, 679, 745, 829, 977, amongst many others. In the year 1702, Tokyo, then known as Yedo, was visited by a very severe earthquake, and violent shocks again took place in 1854 and 1855. I may mention that recent letters from Japan advise me of a severe shock that occurred in Yokohama on the 15th January last, happily attended by no loss of life, but involving much damage to houses and their contents.

PRODUCTS.—I pass on to the products of Japan, and first as to those of agriculture.

Rice is largely grown in the country, and it enjoys the reputation of being of a high standard of excellence, the finest qualities comparing, I believe, favourably with the best Carolina rice. Not only is sufficient grown for native consumption, but there is a considerable balance for export. The grain has several varieties, but it would be out of place in this paper to detail them.

The cultivation of rice in immediate proximity to Japanese towns is an evil, and is, I think, a source of great unhealthiness, not alone to the foreign residents, but to the Japanese themselves. The land is extensively irrigated, and thus large quantities of water lie on the soil for a considerable period, in itself an unhealthy feature; then, too, the turning of the soil and the use of strong fertilisers all tend to make the preparation of rice ground not only a nuisance but a positive danger. It results, therefore, that malaria, in some form or other, is prevalent amongst foreigners in the spring and early summer; and, as regards the Japanese themselves, one cannot but be struck with the poor physique and wan look of the majority of those engaged in rice cultivation. It is possible that at no very distant date the growth of rice in the immediate neighbourhood of towns and populous centres in Japan will be prohibited, a course which is, I understand, followed in some rice-growing countries. Already the Japanese are becoming large consumers of butcher meat, and foreign bread also finds favour with them.

Rice will, of course, for a long time to come, be the staple food of the bulk of the population, but a certain number now live in foreign style, and rice is to these—not much more than it is to us—a mere table adjunct. It is as well to mention by the way that “saké,” the popular native beverage, is brewed from rice; it is generally drunk warm, is of many different qualities, and the best kind is not unpalatable.

Many other cereals are grown in Japan, as wheat, barley, and millet; the soil is very rich, and there are probably no people in the world who know how to turn their land to better account than the Japanese. To

enumerate in detail all that ordinary farm lands or market gardens in Japan produce would be to give a very portentous list, but I may name, in addition to those already given, beans, pease, rape-seed, radishes, turnips, onions, carrots, spinach, beetroot, potatoes, yams, cabbages, cauliflower, asparagus, lettuce, parsnips, egg-plant or Brinjals, tomatoes, cucumbers, vegetable marrow, artichokes, and pumpkins.

Tea is, as you are aware, largely grown in Japan. The cultivation has been enormously stimulated by the advent of foreigners. There was an export in 1886 of nearly 28,000,000 lbs. The bulk of the annual export goes to the United States, where Japan tea has always been held in high favour; about 2,000,000 lbs. find their way to Canada. It is curious that Japan tea is not in demand in England, perhaps in great degree owing to the pale colour of the tea after infusion, the popular but erroneous idea in this country being that tea is not of good quality unless developing a strong dark colour. Amongst other products of the soil I should mention tobacco and cotton. The leaf of the former exhibits many different grades, and the finest is well adapted to cigarettes. Most, if not all, the cotton grown is consumed in the country. Vegetable wax, expressed from the berries of a tree, is also a considerable product, and amongst other products not confined to agriculture I may mention camphor, drugs of different kinds, dried fish, fish oil, lacquered ware, porcelain and earthenware, copper, and coal. I might mention others, but I avoid doing so, as I do not seek to make this a commercial paper, embodying full information on Japan trade. I have reserved silk for special mention. This is the most important of Japanese products, meeting not only the wants of the Japanese population as large consumers of silk, but allowing of a considerable quantity for export to foreign countries. It is of course exported in the raw state, usually made up into hanks and bales, and finds its way mostly to Lyons, to other European silk emporiums, and to the United States, that country having of late years become a large purchaser of Japan silk. The latest return—that for the past year 1886—shows an export of 27,000 bales, representing a value of over £3,000,000.

MINERALS.—Minerals may now find a place, prominent amongst which are copper, lead, iron, antimony, and sulphur; gold and silver are also found, though not to a very great extent. Coal merits special notice, the annual output being considerably over 1,000,000 tons. It is found extensively at Takashima, near Nagasaki, and also at places on the west coast of Kiushiu. There are also large coal-beds in the northern island of Yezo.

FLORA.—Japan is rich in forests, and the vegetation that greets the eye is luxurious in the extreme. Amongst the principal trees, I should name the Japanese cedar, pine, maple, camphor, and many others not having their exact counterpart in this country. Many yield not only

very durable wood, but wood of the most beautiful kind, taking a fine polish, and used extensively in cabinet work. Bamboos abound, as do also camellias of the single and double variety. There is probably no more beautiful sight in early spring in Japan—say, in the beginning of March—than the clusters of camellia shrubs and trees laden with their blossoms of red and white.

The presence of the cryptomeria, pine, and many other non-deciduous trees, gives to the country, even in mid-winter, an appearance of summer, so far as vegetation is concerned.

Of fruits there are several varieties—strawberries, melons, plums, peaches, apples, pears, grapes, persimmons, figs, loquats, oranges, cherries, walnuts, and chestnuts. This seems a goodly list, but some of them scarcely deserve the names given them. To make a selection of good fruit I should name strawberries, melons, plums, grapes, persimmons, figs, loquats, and oranges. Very earnest efforts have been made by the Japanese to acclimatise foreign fruits, and good apples and pears have been grown on an experimental Government farm in Yezo. The absence of good orchard fruit generally in Japan hitherto is due, I am told by those who have knowledge on the subject, to the heavy autumnal rains, at a time when the fruit requires a dry temperature and a full ripening sun.

Of flowers and flowering shrubs that are indigenous I should name the camellia, already spoken of, azalea, hydrangea, lilies, peonies, the chrysanthemum, daphne, and westeria, while wild roses and lilies-of-the-valley flourish in Yezo.

The Japanese are excellent gardeners, and enjoy a high reputation for their skill in dwarfing trees; they have, too, with foreign aid, been successful in acclimatising many of our own flowers, more particularly roses, tulips, geraniums, orchids, and fuchsias, all of which flourish well in Japan. Of the chrysanthemum the Japanese are ardent admirers; I have seen no more rare sight of its kind than the autumnal chrysanthemum display at the Imperial Gardens in the capital, or at the native flower-shows in and about Yokohama. Our own displays in London are insignificant when compared to them.

FAUNA.—In animal life, and first, as to domestic animals, I should name the horse, ox, dog, and cat, which abound in the country. Oxen are largely used for draught purposes, but the increasing taste for animal food amongst the Japanese, and the large demands by foreign residents and foreign shipping, have probably tended to the diminution of the number of animals for draught. Deer are numerous, more particularly in the north, and bears exist in great numbers in Yezo. Wild boar are also plentiful, and my list is about complete with badger, fox, monkey, hares, and a species of wild goat.

The Japanese coasts teem with fish, the principal of which are salmon, cod, herring, sole, mullet, and many others. A very excellent fish in great demand is the tai. Crabs, oysters, prawns, and crayfish are

secured in great quantities, and carp and trout abound in some of the lakes and rivers. I have myself had excellent fishing in the north, securing with the fly large salmon-trout of five or six pounds weight, also innumerable small speckled trout and dace. Eels, of which the Japanese are very fond, are taken in great quantities.

Japan is not remarkable for birds of song or of beautiful plumage, unless I except the copper pheasant and the gold and silver variety of the same bird. The common pheasant is often met with, as are also quail, snipe, woodcock, pigeon, and many varieties of waterfowl. Small hedge birds are not numerous, the sparrow excepted. Larks are fairly common, and a bird known as the Japanese nightingale has a very melodious note. The Japanese are fond of cage-birds, and canaries are plentiful and cheap. Domestic poultry are raised in great quantities, and the small Japanese bantams are well known to fanciers.

I have now, I think, led you through much that appertains to a paper proper to be read before a Geographical Society ; but before concluding, I would ask you to turn your eyes from the Japan of the past to the Japan of the present. I fear that to many here at home Japan is little more than a name, associated with a quaint civilisation, with some hazy notions about the Mikado and the Taikun, accompanied with a knowledge more or less sound of Japanese wares, comprised under porcelain, bronzes, and lacquer ware. Japan should be a great deal more than this to you, destined, as I think the country is, to play no small part in the world's history ; and its laudable efforts to emerge from the position we are prone to assign to Eastern nations, and to take its place in the family of nations, should, I think, receive hearty recognition from the English in general and from the Scotch in particular. I will close my paper, therefore, with brief mention of what Japan has secured for herself at the present day.

The country has now 458½ miles of railway open to traffic, 398 miles in course of construction, and 290 miles in contemplation. Those actually constructed are from Yokohama to Tokyo, 18 miles ; Hiogo to Ozaka, 22 miles ; Ozaka to Kyoto, 27 miles ; Kyoto to Otsu, 11¼ miles ; Tsuruga to Ogaki, 49 miles ; Tokyo to Maebashi, 68¼ miles ; Takazaki to Yokogawa, 18 miles ; Taketozo to Kisogawa, 40 miles ; Shinagawa to Akabane, 13 miles ; Navotsu to Sekigawa, 18 miles ; Kisogawa to Ogaki, 12¼ miles ; Omiya to Utsunomiya, 49 miles ; Utsunomiya to Shirakawa, 48 miles ; the Temiya-Sapporo and Poronai line, the only one in Yezo, 56½ miles ; and Ozaka to Sakai, 8 miles : those in course of construction, Sakegawa to Ueda, 52 miles ; Shirakawa to Fukushima, 55 miles ; Fukushima to Shiogawa, 58 miles ; Yokohama to Nagoya, 215 miles : those in contemplation are Sendai to Awomori, 240 miles ; Oyama to Kirui, 32 miles ; and Kirui to Maebashi, 18 miles. The Japanese fully appreciate the advantage of railroads, and very few days pass in Japan without some notice appearing in the press of a projected railway scheme.

I have, however, confined myself to actual facts of accomplishment, or of what is really likely to be carried out in the near future. All the lines named tap important centres of production, or connect—as, for example, in the cases of Yokohama and Tokyo, Kobe and Osaka—large business emporiums.

Telegraphy is much used and well understood in Japan. Not only is the country in communication with Europe by means of two lines, the one by way of Shanghai and Hong-Kong, the other by Vladivostok and Siberia, the connecting cables being laid from Nagasaki; but there are in the Japanese empire itself close on 7000 miles of telegraph line, with 16,000 miles of wire, also eight submarine cables, not counting that from Nagasaki, with a total length of 51½ miles.

While the first railway in Japan, that connecting Tokyo and Yokohama, was begun in 1870, and completed in 1872, the first telegraph, also between Yokohama and Tokyo, was erected in 1869. The Japanese were, of course, indebted to foreign aid in the early construction of railways and telegraphs, but they are now in great measure independent of such assistance.

The postal system in Japan is excellent, and it should not be forgotten that the country is a member of the Postal Union. The foreign mails are delivered with regularity and despatch, and the domestic postal service is admirably worked. Japan sent an officer of rank to the recent Postal Conference at Lisbon, and, indeed, there is scarcely a non-political conference of international importance to which Japan does not send a delegate.

In educational matters the Japanese take a high place. When I first arrived in Japan in 1860, it was an uncommon thing to meet with a Japanese who could not read or write to some extent, and education has taken rapid strides since then. It is compulsory throughout the land, special rates being levied for the purpose. Every child is regarded as of school age from its sixth to its fourteenth year, and the course at primary schools must not be less than three or more than eight years. At least thirty-two weeks in each year must be given to instruction, and the hours not less than three or more than six daily. There is a university at Tokyo, with its affiliated colleges, affording opportunities for pursuing most branches of learning, and it must also be borne in mind that many Japanese students come to the United Kingdom to obtain that scientific or expert knowledge which can in some cases be more easily commanded here than in Japan. There are at the present moment about 100 Japanese students in England and Scotland, and about 150 in Germany. This is not a paper I wish to burden with statistical figures, but I may mention that there are in Japan close on 31,000 schools, in which number is included 1 university, 142 colleges, and 65 normal schools. The number of teachers is about 102,000, and of pupils about 3,325,000. English is now pretty generally taught throughout the empire; and, as giving an idea of what is taught in special schools, I may mention what came under

my notice shortly before I left Japan. There had recently been established in the capital, Tokyo, a peeress's school, under the special patronage of the empress, and under the supervision of the imperial household department. Two courses of instruction, primary and middle, are prescribed, and I give in detail the subjects of both. The lower grade of the primary course includes writing, arithmetic, geography, drawing, music, needlework, gymnastics, and physics. The higher grade of the primary course includes all the above, with the addition of political geography, history, and natural history. The lower grade of the middle course takes in Japanese literature, European languages, chemistry, and mineralogy; the higher grade, algebra, geometry, history, physiology, zoology, botany, domestic and political economy. The courses extend over twelve years—six for the primary, and six for the middle.

To pass to Japan's war strength. The army is one of significant proportions: conscription is the rule, and every male of certain age is, with certain exemptions, liable to service.

The peace footing of the Japanese army numbers 60,000 men, expanding to a war establishment of 185,000, and these not levies of raw, undisciplined men, but men who have gone through a regular course with the colours. The troops are armed with the most modern weapons, and any improvements in arms that may be adopted by European nations the Japanese are not slow to adopt for themselves.

The navy of Japan numbers about thirty-five vessels, exclusive of torpedo boats. The number is small, but the Government is giving great attention to the increase of its naval strength. Already in this small fleet there are vessels of the highest type, both in respect of speed and armament; and I need only mention the two celebrated Armstrong cruisers, the *Takachiho* and the *Naniwa*, which arrived out shortly before I left, to show that I am not speaking without a knowledge of the facts. The *personnel* of the navy number 8500 officers and men. They make excellent sailors; and the number of deep-sea fishermen engaged on the coast constitutes alone a never-failing source of supply of men, not to mention the lads that are drilled on the training vessels of the Japanese navy. There is a naval dockyard close to Yokohama, at which vessels are not only efficiently repaired, but where men-of-war are built and engined throughout. Three good docks exist at the yard, the largest being 502 feet over all in length, the smallest 308 feet.

From the navy I pass to the mercantile marine. The junk is still a familiar feature in Japanese waters, but is destined, so far as the larger crafts are concerned, soon to disappear, a Government order having gone forth that no more junks over a certain tonnage are to be built. A Government edict was, however, scarcely necessary to this end, as there is a strong predilection in the Japanese mind for vessels of foreign build. Small schooners for the coasting trade, built by Japanese shipwrights, are now a favourite style of craft; and the country possesses an imposing mercantile marine in the fleet of steamers that belong to the Nippon

Yusen Kaisha, and which run not only to all the more important coast ports, but regularly to Shanghai, in China ; to Corean ports, and at times to Vladivostok, in Russian territory.

I should not fail to notice the judicial system of the country, which will sooner or later largely affect foreigners in Japan, when the ex-territorial jurisdiction of which I have made mention comes to be abolished. The system that exists is modelled rather on the French or Continental plan than on ours : there are courts of first instance, from which an appeal lies to the Superior, and from that to the Supreme Court, together with courts of simple police and correctional courts. These are all presided over by Japanese judges, some of whom have been called to the bar in England, or have successfully prosecuted their legal studies elsewhere. All these courts exercise jurisdiction over Japanese alone. In the opening part of this paper I explained the system of ex-territoriality under which foreigners are subject only to their own consular tribunals.

I find I have not mentioned the press, which is singularly active in Japan. Amongst the leading Japanese newspapers are the *Yomiuri Shimbun* or *Crier*, which has an annual sale of about 4,600,000 copies ; the *Jiji Shimbun* or *Times*, with a sale of about 2,300,000 ; the *Hochi Shimbun* or *Intelligencer*, with a sale of 1,700,000 ; the *Choya Shimbun*, or *Court and Country Gazette*, with a sale of 1,500,000 ; the *Nichi-nichi Shimbun* or *Daily Recorder*, with a sale of 1,300,000 ; and the *Mainichi Shimbun* or *Daily News*, with a sale of about 1,000,000. All these papers are printed in the Japanese character ; they are for the most part conducted with singular ability, and are a potent factor in the education of the people. There are, in addition to these, English papers published at the open ports under the responsibility of English proprietors and editors—such as the *Japan Herald*, *Japan Mail*, and *Japan Gazette* at Yokohama ; the *Independent*, under American editorship, at Tokyo ; the *Hiogo News* at Hiogo ; and the *Nagasaki Express* at Nagasaki. I should not omit the *Japan Punch*, which has been in existence for many years at Yokohama under English editorship.

The Japanese are omnivorous newspaper readers, and it is a common sight to see your domestic servant, male or female, with his or her own particular daily journal.

I have left untouched to the last the subject of area and population. The former is computed at 146,566 square miles. Of this, about 31,500,000 acres are actually under taxation, and about 11,176,000 under cultivation. The latest census returns, prior to my leaving in November last, gave a population of 37,868,987, of whom 19,157,877 were males and 18,711,110 were females. The population is made up as follows :—Imperial family, 38 ; peers, 3350 ; gentry, 1,938,204 ; agricultural and industrial classes, 35,927,395. The European and American residents in Japan number about 2300, of whom about 1070 are British ; 450 Americans ; 270 German ; 200 French ; and the balance of other nationalities, excepting Chinese, of whom there are about 4000 in Japan.

A last word as to revenue and expenditure, which I find, according to late returns, to be, as to revenue, £12,449,236, and expenditure £12,448,169.

The national debt is computed at £40,904,555, and the amount of paper money in circulation is estimated at £11,441,535. The principal sources of revenue are the land tax, the tax on the native liquor *saké*, that on tobacco, the Custom duties, and postal receipts.

ZEMO-KARTLI, OR UPPER GEORGIA.

By D. R. PEACOCK, H.B.M. VICE-CONSUL, BATUM.

THE territory comprising the districts of Kars and Batum was for some time, upon its annexation to Russia, looked upon as a naturally rich and promising field of colonisation and enterprise, and even now is partly so considered, without any apparent reason, excepting the prestige of novelty. It is not my present object to give an account of its natural resources and local economic conditions, nor do I venture to assert that the potential capacities of the territory are unworthy of consideration. But I certainly feel no hesitation in stating that the land, and the people who have been occupying it for over one thousand years, if compared with any more or less prosperous locality of the world, are under present circumstances and conditions, from a purely economic point of view, both unproductive and poor.

With an area of about 10,000 square miles, and a population of 260,000 souls, it yields to its present rulers an average yearly revenue of about £34,000, which sum, it need scarcely be added, does not by far cover the various items of annual expenditure incurred by the Government in the two districts. As an important limb of a vast political body, it might, perhaps, in a certain sense, notwithstanding its financial deficiency, be considered a profitable acquisition; but as a market or a field of investment it offers but very little encouragement.

The topographical features and the climate of the country, the very character, habits, and tastes of the population, practically preclude the possibility of profitable co-operative agricultural or industrial life. Local production, as well as local consumption, are not only, in regard to the degree of development, confined to limits fixed, as it were, by immovable natural barriers and long-standing, deep-rooted social causes; the very methods of production, and the kind and nature of the articles locally produced or consumed, have been fixed with precision and uniformity by preceding generations, which it is not so easy to counterfeit or infringe upon as in the case of our ever-varying modern trade-marks.

The notion that this territory is, economically speaking, a new one, waiting only to be tapped, and that the native population has not yet had the requisite opportunities for displaying much vigour and energy in their

industries and trade, etc., etc., is both misleading and erroneous. The soil is neither a virgin one, nor are the natives a young people open to foreign influence, and convinced of the necessity of improvement and progress. Their manners and customs are as old as those we read of in the Bible. Such traces of culture shown by the plots of land on almost inaccessible rocky hillsides, levelled and manured, and brought under tillage at enormous cost of time and labour; the many fruit gardens, vineyards, the groves of olive-trees in the secluded valleys of the Tchrorokh (Choruk); the still practicable, arched stone bridges, spanning the different mountain-streams; the numerous remains of forts and castles, of Christian temples of worship, churches and monasteries, bearing inscriptions in the language spoken in the country even nowadays—all these point back to times when we Europeans were scarcely more than barbarians, whilst the people in possession of this territory, whose descendants we unmistakably recognise in the present populations, had attained to a comparatively high degree of social and economic development. The above remarks relate exclusively to the people inhabiting the interior, and not to the town populations.

The two towns, Kars and Batum, which gave their names to the territory annexed to Russia by virtue of the Treaty of Berlin, are, it should be borne in mind, in no way essentially connected with their respective districts. Both places have become famous and of importance, but not because of any growing agricultural and industrial life in the interior. Kars owes its importance to its forts and strategical position on the open table-lands of Armenia; Batum, to its deep and sheltered harbour, its famous though short-lived reputation as a "free port," and the fact of its having been eventually turned into a strongly fortified military port to serve Russia as a coign of vantage on the south-eastern coast of the Black Sea. However rapid the growth of its shipping and trade during the last few years, it has had, so far, no material effect on the lands lying in its close vicinity, and must be looked upon as the outlet and shipping-place, not of the district bearing its name, but of the distant markets and centres of production lying hundreds of miles away beyond the Suram range.

Although the districts of Kars and Batum may be said to occupy, on commercial grounds, but a very secondary position, they involve questions of no little interest from a purely geographical and historical point of view, to say nothing of their important political situation. Though now forming part of the extensive administrative region of the Caucasus, they cannot be justly said, geographically speaking, to belong to what is known under the general, but imperfectly defined, terms "Caucasus" and "Transcaucasia," the application of which terms, it would seem, has been successively extended, in proportion to the extension of Russia's political boundary in this direction. Before the last Russo-Turkish war, the territory comprising the present districts of Kars and Batum, whilst under Turkish rule, was spoken of as forming part of Anatolia or Asia Minor; and now being annexed to Russia, it is said to belong to the Caucasus or

Transcaucasia. Such laxity in regard to geographical nomenclature should certainly be avoided.

A glance at a map representing the configuration of the Caucasus on the one side, and that of Anatolia on the other, could scarcely fail to convince one that the volcanic table-lands of Kars, and the confused mass of elevations cut and split by the Tchorokh, and the different tributaries of that river, are orographically connected with, and have their backbone in Asia Minor, not in the Caucasus. Not one of the rivers draining this country has its head-waters in the mountain-range of the Caucasus. The principal streams come from a side quite opposite to the Caucasian chain, and in their general course through this locality flow, not from, but towards that mountain-range. They are fed by elevations departing from the eastern extremities of the Anti-Taurus, and forming in the vicinity of Erzerum the remarkable watershed which sends out the three well-known rivers, the Euphrates, the Arax, and the Tchorokh, from the same spot, as it were, to three widely separated seas respectively—the Persian Gulf, the Caspian and the Black Seas.

As regards the general aspect of the relief of the territory under consideration, it will be found to be very different from that of the Caucasus. The latter, being a regular chain of mountains trending in a well-defined direction, has scarcely any parallel ridges, no plateaux, and no mountain lakes. The former is all confused and irregular; consisting, as it does, of extensive table-lands impinging upon broken ridges stretching in all possible directions, along as well as towards the sea-coast, it has mountain lakes like the Tchildir Göl, more than 6500 feet above the sea-level; and there are not a few isolated peaks, like the Kartchkhal, 11,248 feet high, which one is at a loss to assign to the different distorted ranges to which they originally belonged. Between the two groups of massive elevations—that is, the Caucasus on one side, and the plateaux and ridges forming the eastern extremities of Asia Minor on the other—there is a vast depression, consisting partly of marshy and jungle bottom-lands, and partly of cultivated and exceedingly fertile open river valleys, turned, as in Imeretia, Gouria, Mingrelia, and Samurzakan, towards the Black Sea, and as in the districts of Tiflis, Elizavetopol, and Baku, towards the Caspian. The Meskhi-Suram range, rising above this depression, and dividing the same into the Cis-Suram and Trans-Suram lowlands, both forming parts of Trans-Caucasia, might be pointed out as the only conspicuous connecting-link between the two above-mentioned groups of elevations—namely, the Caucasus and Asia Minor. However, considering its connection with the Adjara-Akhhaltsikh range, its relative dimensions and heights, decreasing as it trends northward, and finally its peculiar direction, so entirely different from that of the main range of the Caucasus, one would, indeed, rather take it for an outgrown limb of the plateaux of Asia Minor, or otherwise for a bridge spanning two opposite banks, without necessarily forming an essential part of either of the two sides.

Whilst, from a geographical point of view, the territory comprising the

districts of Kars and Batum should thus be regarded as a group of elevations forming no part of the Caucasus, it must be admitted that, on historical grounds, it decidedly stands in very close and intimate connection with the Caucasus.

The names Lazistan and Armenia, as indiscriminately used by Europeans, the former in relation to the territory surrounding Batum, the latter to the table-lands of Kars, are neither officially recognised nor in general use among the natives, and convey an erroneous notion as to the proper limits of the ground that may justly claim those historical names. As it is, Lazistan occupies but a narrow strip of land along the sea-coast, stretching from the left bank of the Tchorokh towards Riza ; and, as to ancient Armenia, it comprised only a portion of the table-lands of Kars. The sea-coast being the most accessible and frequented part of the country, Lazistan naturally became better known than the secluded and almost inaccessible localities in the interior. Thus, the name Lazistan, though actually relating to a portion of a certain territory, was not unfrequently, owing to ignorance, applied to the whole. Armenia, to say nothing of its notorious past, has lately been made so prominent an object of political solicitude, that neither geographers nor the public at large were allowed to forget the historical name of that country. In the meantime, Georgia, having since 1801 virtually ceased to attract any attention on political grounds, not only facts and names of historical interest, but even still existing geographical terms relating to that country are being ignored and entirely forgotten. Thus, certain localities situated in the present district of Kars—such as Poskhov, Ardahan, Olti, etc.—unmistakably formed part of ancient Georgia, and are not on Armenian soil, though this fact is scarcely recognised.

The most detailed and trustworthy description of the territory forming the subject of this paper, as it was known before either Turkish or Russian influence had time to bring about any changes in the original place-names, belongs to the Georgian geographer and historian, Tsarevitch Vakhushit, the natural son of the Georgian King, Vakhtang VI. His admirable work, *The Geographical Description of Georgia*, was written in the first half of the eighteenth century, and eventually translated into French by M. Brosset, member of the Imperial Academy of St. Petersburg. The information therein contained, especially that relating to the different localities of the basin of the Tchorokh and its tributaries, may be considered decisive and unimpeachable, not only because they tally with the historical records of Georgia, but also, and much more on that account, because of the evidence we find on the spot in the numerous remains and relics of the past, bearing Georgian inscriptions, the old Georgian place-names being still in local use ; moreover, the physical and even the moral features of the natives, and the language spoken in the country, are those of the genuine Georgian race, the same as faithfully described by Vakhushit.

The whole basin of the Tchorokh, with the numerous valleys and gorges of the rivers Olti, Smerkhevi, Adjaris-tskhali, etc., as well as the

elevated lands drained by the head-streams of the Kura, formed since ancient times a very important portion of the once extensive Georgian realm, and was known, owing to its comparatively elevated position, under the general name of Zemo-Kartla—a name which in Georgian means Upper Georgia, in contradistinction to Shida Kartla—or Central Georgia, situated lower down along the river Kura. Upper Georgia was also called at different times by the names of “*Samtskhe*” and “*Saathabago*,” the Georgian prefix *Sa* denoting “of” or “pertaining to.” Hence *Sa-Mtskheto*, or, in its abbreviated form, *Sa-Mtskhe*, meaning the country of Mtskheto (the eldest son of Kartlos, to whose lot that portion of Georgia fell when that kingdom was divided upon the death of Kartlos); also *Sa-Athabago*—that is, the country of or subject to the Athabeg (the Athabeg being the supreme local authority established during the reign of George the Illustrious). “*Zemo-Kartla*,” or “*Samtskhe*,” or “*Saathabago*,” which we may call simply Upper Georgia, when a separate province, also comprised on one side the territory occupied by the present districts of Akhaltsik and Akhalkalaki, and on the other the Tortum valley and the head-waters of the Tchorokh, still in Turkish territory.

The boundary of ancient Georgia thus extended much further westward than the present Russo-Turkish frontier-line. It actually touched the mountains of Deveboyun, close to Erzerum; then stretching along the eastern head-stream of the Tchorokh, where the Georgian “*Sakartvelos-Keli*,” or the Turkish “*Gürdjî-Boghaz*” is to be found (the former meaning “the throat of Georgia,” the latter “the gate of Georgia”); it reaches Baiburt, and thence takes a northerly direction towards the Black Sea, near Riza, to the west of which place were supposed to stand the famous Georgian iron pillars (“*Rkinos Palo*”), being the cairns or land-marks of the extreme western limit of ancient Georgia on the coast of the Black Sea. “Such was the boundary-line,” says Vakhusht, “between Georgia and Greece.”

The different inhabited localities of Upper Georgia retain their Georgian names to this day. Adjara occupies the whole valley of the river Adjaris-tskhali and the mountains surrounding the same; Shavsheti comprises the basin of the river Smerkhevi; Livane consists of the deep gorges and sheltered fruit-bearing valleys of the Tchorokh above and below Artvin; Poskhov is drained by a stream of the same name; Taos Cari by the Olti-tchai; and the Güle, the ancient Cola, by the numerous head-streams of the Kura. The bulk of the present population inhabiting the above-mentioned localities are of Georgian origin, and speak Georgian, excepting the people of the modern districts of Olti and Ardahan, who speak chiefly Turkish, and have almost entirely forgotten their native tongue.

The Lazi, on the left bank of the Tchorokh, occupying the tract of land stretching along the coast as far as Riza, and called by the Georgians Djaneti, the modern Lazistan, speak a language similar to—one may say

almost identical with—that of the Mingrelians, which is in reality but a dialect of the Georgian tongue.

It is an historical fact that these people of Georgian origin, who embraced Christianity as early as the fourth century, and were known for over a thousand years as the most zealous champions of the Christian faith in this part of Asia, became Mohammedans only in the seventeenth century, being converted to that creed under the pressure of Turkish rule. But although having forfeited their political independence and the faith of their ancestors, it is remarkable how little they have lost of the characteristic national features peculiar to all Georgians, and how unimpaired the native language has been preserved.

Kaghizman, Shuraghel, and Zarushad, occupying the banks of the Arax, the Arpatchai, and the Kars-tchai are, on historical and ethnological grounds, decidedly Armenian territories, with populations who have retained not only their native tongue, but also their national religion.

The total population of the Batum and Kars districts being about 260,000, it may be roughly estimated that not less than 120,000 belong to the Georgian, and about 40,000 to the Armenian race. The remaining 100,000 are of exotic elements, settled here at different times by way of immigration or conquest. Such are the Karapapakh, Kurds, Greeks, Turks, Russians, etc., met principally on the open table-lands of Ardahan and Kars, where the comparative plainness of the ground, as well as the soil and climate, admit of colonisation for purposes of farming or cattle-breeding, whilst in the deep and tortuous gorges of the Tchorokh, and on the almost inaccessible precipitous hillsides of Shavsheti, Adjara, etc., the aboriginals were naturally protected from foreign settlers, and it is the seclusion and isolation from intercourse with the outer world that account for the fact that the breed and the language of the Georgian race have been preserved here in a state of greater purity and integrity than in the open and more frequented localities of Transcaucasia.

Before concluding this very brief and incomplete account of Upper Georgia, I cannot refrain from alluding to a question which I have often asked myself:—If the hillsides and ridges of the basin of the Tchorokh are so precipitous and difficult, the gorges so tortuous, the streams so tearing and unmanageable, the climate so unhealthy owing to the sudden and frequent changes of temperature and the enormous annual rainfall (above 70 inches in the average)—if, as a result of all these hostile natural conditions, the country may be regarded even now, after having been inhabited for over a thousand years, as practically inaccessible and uncultivable? All communication in the interior is on foot, occasionally on horseback, but never by vehicles, the use of vehicles being impracticable and virtually unknown to the hill tribes; and in order to reach some inhabited or cultivated spot, one has to follow narrow, winding tracks, often with danger to life, and through close, dark gorges or ravines that feel, as it were, oppressed for want of space and light. How much more formidable and hostile must have been the nature of these

localities some thousand years ago, and what was it, then, that could have induced people to come to such almost inaccessible places and settle where there was scarcely a plot of level ground wide enough to pitch a tent upon? And yet it is here where the Georgians have left indelible traces of political and religious activity in the form of numerous remains of castles and forts, and churches, and monasteries, of a more ancient date than those met with in the open and comparatively more accessible fertile plains of the Kura and the Rion.

To the above question, for want of authentic historical evidence relating to the obscure period of the first Georgian settlements in this part of Asia, there can be but one answer. One may, I think with confidence, take for granted that in those dark and bloody times, when Georgia was but in a state of infancy, and continually threatened by more powerful neighbours and the numerous nomadic hordes of Asia, considerations of agricultural and economic advantages must have been out of the question: the defeated, the persecuted, the weak (to make life worth living) looked for refuge, not for comfort and riches. The mountain fastnesses of the Tchorokh and Adjara, rude and inhospitable as they may have seemed to the first settlers, offered the sought-for refuge and protection, and the people who resorted to these secluded and sheltered localities, once finding themselves beyond the reach of the enemy, and their lives and property secured, would cling to the rocks and hillsides, and build their nests there as best they could.

It was through this dark and wild and isolated country that the first ray of Christianity fell upon Georgia, and by its light awakened her people to a new and better life. According to Georgian traditions, the Apostles Andrew and Simon the Canaanite, as early as the year 40 A.D., visited Adjara, Taos-Cari, and Klardjeti. Later on, upon the conversion of Georgia to Christianity in the fourth century, owing to the zeal of St. Nina, commences the period of Georgia's real national and religious life, extending over a period of nine centuries—that is, from the fourth to the thirteenth century—with prolonged intervals of wars and feuds, being at the same time the period of her growth and formation.

It is especially to the latter part of this period that must be traced the construction of the numerous churches and monasteries, castles and forts, the remains of which may still be seen in many parts of the country. With this class of construction, relating to remote times, should not be confounded the erections of a comparatively recent date, which are, one may presume, the traces of a short-lived foreign influence. I speak of the stone bridges spanning the different mountain streams in the form of one or several arches of remarkable durability as to workmanship and of exquisite beauty in style. The natives have very vague and obscure notions as to when and by whom these bridges were built. On inquiring, one is sure to receive but one and the same answer: "These bridges are very old—much older than we are."

Throughout the country there are no vestiges of other ancient useful

works in the way of roads, canals, public buildings, etc. ; but there is scarcely a valley or a hill where one does not discover the remains of either a fort or a church, just as if the people whose work they are cared for nothing else but fighting and praying. Remains of that character are also met with in considerable numbers on Armenian ground—along the Arax, and especially on the right banks of the Arpatchai, where the well-known ruins of the ancient Armenian city, Ani, afford perhaps the greatest interest the archæologist could find in this part of Asia.

At the same time it must be admitted that there is very little left untold concerning the ruins of these ancient Georgian and Armenian buildings, and there is scarcely any obscurity with regard to the question when, by whom, and for what purpose such churches or forts were erected.

There are, however, works by human hands in this country which remind one of habitations of troglodytes, but which in reality remain so far a puzzle and a mystery. The number of excavations at different places in the hillsides and rocks is very considerable. They are either in groups, giving to the mountain the appearance of being honeycombed, or solitary, but always of regular shape and form, with accommodation as dwelling-places, though of a very rough and primitive style.

Subterranean caves are also very numerous in other parts of Georgia, to say nothing of the extensive and beautiful excavations of Vardzia and Uplistsikhe on the bank of the Kura. There is free scope for conjecture as to the time when, and the circumstances under which, caves were being used in this territory for purposes of refuge or habitation ; but we are not in possession of any positive knowledge on this subject. As to the people who made those caves, or dwelt therein, we may only ask ourselves, recalling to our memory a passage from the Bible, whether they were those who “were driven forth from among men to dwell in the cliffs of the valleys, in caves of the earth, and in the rocks” ?

THE GEOLOGY OF EAST INDIAN ARCHIPELAGO.

FEW Englishmen have any fair conception of the large amount of scientific investigation that has been carried out by the Dutch in the territories possessed by them in the East Indian Archipelago ; and the materials thus accumulated are too little utilised by English workers in their special departments. An interesting treatise by H. van Cappel on “The Character of the Dutch-Indian Tertiary Fauna”¹ has recently appeared ; and, as certain points of geographical moment are brought under consideration, we here present a *résumé* of his results. The various fossils hitherto found in the Dutch Indies belong to Carboniferous Lime-

¹ *Het Karakter van de Nederlandsch-Indische Tertiaire Fauna.*

stone, Cretaceous, Tertiary, and Post-Tertiary formations. The Tertiary has yielded by far the greatest number of species, and these have been obtained from the most distant parts of the Archipelago, though especially from Sumatra, Borneo, and Java. The limestone fossils have hitherto been discovered only in Sumatra and Timor. A comparatively unimportant place in the list is occupied by the Post-Tertiary fossils from the so-called "Tin Soap" Mountains of Billiton and the fossils from West Borneo, which are provisionally regarded as Cretaceous, owing to a certain similarity they have with well-known European forms.

In Sumatra the Limestone is confined to the west side of the island. It there consists of two distinct divisions, a lower of marl and an upper of dark limestone. Among the numerous characteristic fossils obtained from the latter formation, *Fusulina* is the most important; and as the same occurs in limestone banks enclosed by the strata of the lower series, the two divisions are evidently of similar origin. As regards its fauna, the Timor Carboniferous Limestone is quite different from that of Sumatra; the connection of the two with each other not being greater than that of either with the Carboniferous Limestone of Europe. This formation is widely spread in Timor, and presents three varieties known as grey, red, and brown Carboniferous Limestone. The red variety is well developed, especially in the west of the island; the grey has hitherto been observed only in the neighbourhood of Kupang; and the brown is known only as a rolled stone in the Oisain stream. While palæontologically the Timor Limestone is more akin to that of Europe, petrographically it is much more dissimilar. In Sumatra the Carboniferous Limestone is disrupted by greenstone dykes, and the limestone is in many places greatly metamorphosed. The exact age of the rock is, of course, not ascertainable, as the formations between the Limestone and the Tertiary appear to be absent. In the Padang Highlands this greenstone takes part with gabbro and serpentine in the structure of the mountains; in South Sumatra, on the other hand, it is absent, as well as the Carboniferous Limestone. Owing to the very imperfect state of our knowledge of the geological structure of most of the islands of the East Indian Archipelago, we may consider it probable that the Carboniferous strata will be discovered in other places, and that when they do not appear at the surface they may in many cases be simply concealed by more recent formations.

We now pass to the Tertiary formations. This formation is very strongly developed in the Dutch Indies. It forms not only the greater proportion of the Javanese soil and a very great part of that of Sumatra and Borneo, but it also appears more or less spread over all the other islands. As the relation of the several Tertiary deposits cannot be satisfactorily determined, we must be content to treat the Tertiary formation in each island by itself.

First, in Sumatra, this formation is well developed, and appears to be in great measure represented by the Eocene, which has been divided

into four stages, known as Nos. I., II., III., and IV. But it must be observed that the determination of these deposits as Eocene rests on badly preserved fossils. The oldest stage or horizon is known as the breccia stage, consisting of breccia, the material of which, as well as that of the sandstones with which it is intermingled, is derived from limestones, syenites, and granites. The sandstones alternate with marls, which are important because of the remains of fish they contain, and these remains have led some palæontologists to refer the rocks to the most modern division of the Cretaceous, while others again, instead of making them older than the Eocene, consider them as Miocene. In West Sumatra, near Bukit Kandung and Lurah Tambang, this stage is represented by limestone in thin layers appearing between sandstones, and containing badly preserved fossils. In South Sumatra it occurs on the Saputi River, but is destitute of fossils. The second stage, consisting of sandstone, clay, rocks, and coal-beds, lies above the first, for the most part conformably, in West Sumatra. The thickness of the coal-beds would seem to indicate that they are formed of plants which grew *in situ* and on a clay soil which now as a clay-rock forms the substratum of the coal. Above the coal comes sandstone, which in some places reaches a thickness of 1000 feet, and contains no fossils. In South Sumatra this series of rocks, which is of so much economic value to the Dutch, is absent. The third stage consists of marly sandstones, which must be regarded as a marine formation, since the remains of sea-shells have been found in them. It is developed in West Sumatra, but appears to be absent in South Sumatra. The fourth stage is a limestone formation, which, besides numerous corals, molluses, and echinides, contains a great number of Orbitoids, and is consequently known as "Orbitoid" limestone. It is developed both in West and South Sumatra, and is the source of most of the Tertiary fossils that have been described from this island. Miocene deposits appear more extensively in South Sumatra than in West. They occur in the Padang Highlands, and have there yielded a number of well-preserved fossils. The marl-rocks near Lubuk Lintang (Seluma district, Bengkulu Residency), contain a great number of a sort of *Eburna*.

The island of Nias consists of a series of hills, in the formation of which the Tertiary rocks have played a great part. They are marls, and appear to be a continuation of those of Sumatra. Thin coal-beds are found among them here and there, but of a quality that gives them no economic value. The fossils obtained from these deposits indicate a Miocene origin. A coral limestone which covers the tops of these hills is by some considered as Pliocene, by others as Miocene, the fossils being of an indefinite nature. As for the Batu Islands, to the south of Nias, all that is known is the existence of a Tertiary formation, which may be regarded as a continuation of the Padang Highlands.

In Java the greatest portion of the surface is formed by Tertiary deposits, which have been divided into two series. The older of these (though no fossils have as yet been found in it) is considered to be

Eocene. On the south coast of Bantam—in the basins of the rivers Sihi, Madur, and Savarma, for example—the rock is a quartz sandstone; in other places, as, for instance, on Mount Nungang, near the village Guha, an Orbitoid limestone. Also in Djokyakarta, Tertiary rocks, in which occur various fossils, led geologists to credit Java with an Oligocene formation. From the same locality, however, a number of fossils have been examined that show a great agreement with various well-known fossils from Western Java, and are consequently recognised as Miocene. The soil of the western part of Java is composed, for the most part, of Miocene deposits, from which a very great number of well-preserved fossils have been described. This formation reaches in some places an enormous thickness, which in the Residency of Cheribon, for example, is estimated at least at 3000 mètres. Pliocene strata, though they cover a less area, are also developed in Java; they consist mainly of limestone, which is covered by Miocene deposits. Though the Tertiary deposits of Java and Sumatra have not, as yet, been co-ordinated, there is little doubt that the investigation of better-preserved fossils from Sumatra will lead to this result.

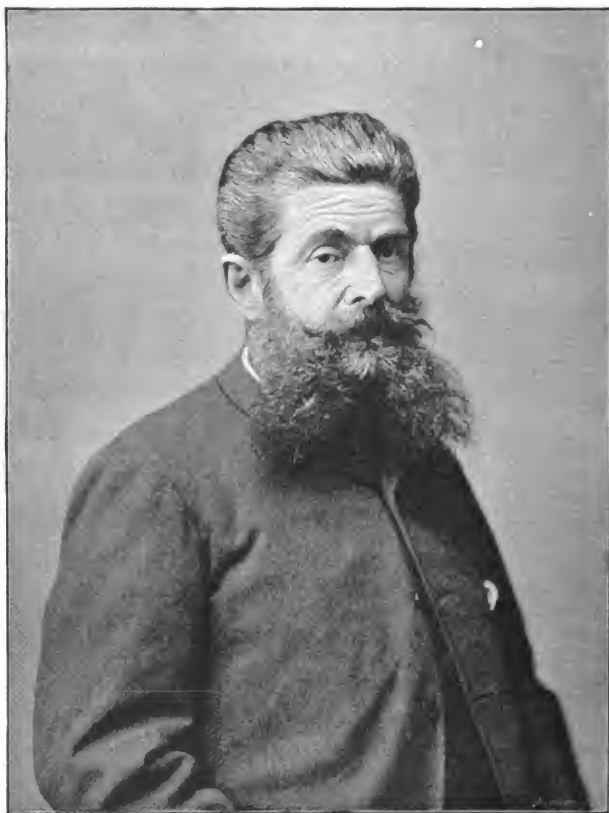
In Madura, Tertiary deposits occur which may be considered as a continuation of those of Java. The same peculiar rocks with *Cyclocypeus annulatus* (Mart.) and *C. Communis* (Mart.) are met with in this island. The coral limestone of Java is also found, and other rocks which agree entirely with the Tertiary limestones of Djokyakarta, Samarang, and Kediri.

TRAVELS IN CENTRAL AFRICA.

An Abstract of DR. JUNKER'S Address to the Society, May 1887.

DR. JUNKER began by remarking that Scotland had always been deeply interested in Africa, and he believed they had some knowledge of his first journey in that country, from which he returned in 1878. That night, however, he would deal only with his second journey, which occupied seven years from 1879, and, commencing at Cairo, ended at Zanzibar only in December last. His purpose was to give an outline of his wanderings in the Equatorial Provinces of Africa, confining himself chiefly to the events of the past few years. He wished principally to treat of that region in which, at the present moment, Emin Pasha, with his soldiers and a small band of officials, were patiently holding out till the hour of deliverance arrived.

When he set out in January 1880, it was his purpose, he proceeded to say, to explore the regions of the Wellé, and to follow the stream as far as possible to the west, hoping to find a definite solution of the long open question whether the Wellé, first discovered by Schweinfurth, belonged to the Congo or to the Chad. As was his wont, he sent messengers to the chief of the region to which he wished to go, to give particulars of him (Dr. Junker), and to make a great point of the fact



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that he travelled without any military escort. He never, he said, entered the territory either of a powerful ruler or of the meanest chief without first waiting for his messengers, who generally returned immediately with those he (Dr. Junker) had previously despatched with small presents for the chiefs. About the month of May he reached Ndoruma's territory, and, with the aid of hundreds of labourers whom that chief provided, he erected a number of good substantial huts, which he surrounded with a high stockade as a protection against leopards, which abounded in the neighbourhood. Negresses were often carried off by these animals, generally when carrying water in the twilight.

Dr. Junker proceeded to narrate the difficulties under which hunting was pursued in Central Africa. On account of the long growth of the grass, travelling, during the rainy season, was rendered much more difficult. The narrow footpaths made use of by the Negroes, and partly trodden out by wild animals, were almost concealed by the rank grass. In many journeys he had frequently been unable to see the man walking immediately in front of him. For hours he had been compelled to protect his eyes from the waving stalks with his lifted arm. In December and January the grass became so dry that it could be burnt. The extensive grass conflagrations were very sublime but terrible spectacles.

After two months' residence at Ndoruma's, he resumed his journey in August, with only twenty bearers, and the most necessary presents for the Negro chiefs. During his stay at Ndoruma's he had put himself on good terms with many of the chiefs, and he received permission to pass through their territories. As early as January 1881 he was on the way, by a new road to the south-west, to the Madi district. He obtained a number of bearers with the greatest difficulty, and they afterwards robbed him of a part of his goods, and abandoned him, so that for the time he had to give up all thoughts of travelling in the direction he wanted. Then followed two months of trouble in constructing huts in the wilderness and in endeavouring to find provisions. At the end of November 1881 he was able to execute his plan of leaving the Madi country. Up to June 1882 he carried out various excursions in the neighbourhood, and he met with a friendly reception from the powerful Niam-Niam tribe.

Dr. Junker then explained various customs of tribes, including the sacrifice of slaves taken in war. The Mangbattu chiefs, he said, were always surrounded in council by their wives, some of whom used to come to his (Dr. Junker's) evening fires, and join in the conversation. The clothing of the women consisted of pieces of bark cloth, which, on sitting down, they laid over their knees. The wives of the principal chiefs were not so satisfied with this covering, and they had become in consequence very ingenious: they had succeeded in learning how to paint their bodies with geometrical lines, with regular squares, or large round spots in every variety of design. The body of a Mangbattu woman of fashion

often was only to be compared to an inlaid floor painted in three colours, and from time to time they would discover new and startling patterns. The toilet articles of a Mangbattu woman were very simple. They consisted of a small pot of dark brown oil, two pieces of broken dish—one containing red and another black colour, and some pieces of wood to lay the colour on, and, finally, a few hair-pins, carved out of ivory, which served as combs for their woolly hair. Besides painting their bodies—which often took a long time, and required the help of other women—they spent time in putting their hair into artificial knots over six inches high. In patience and perseverance at the toilet the Mangbattu women excelled their more civilised sisters.

Having related some hardships which he underwent, Dr. Junker proceeded to say that in August 1882 he left for good the country south of the Wellé river, and, travelling by a new way to the north, arrived in December at another new station.

On his last tour, which continued till May 1883, Dr Junker travelled first to the south-west and reached the Wellé-Makua, and he explained that during his stay in this region he frequently received letters from Lupton Bey, telling him of sanguinary fights between his own troops and the natives, who were subsequently reinforced by the Mahdi's troops from Kordofan. Dr. Junker wished it to be known that sufficient credit had not been given to Lupton Bey for the arduous fights which he made in this district. He said that, at the same time, it was necessary to excuse the public for their want of knowledge, because no news had penetrated from that part, and he himself was the last European who had come to Europe from the Central Provinces which once belonged to Egypt. Lupton Bey wrote at one time that he believed he had conquered the insurgents. On one occasion he lost 500 men, the rebels nearly 2000.

Dr. Junker had intended to finish his journey and to return to Khartum. He was, however, compelled, on the 16th November, to strike to the east, and he reached Emin Pasha at Lado in January 1884. From that time up to March 1886 no news of the events in the Sudan had reached them, though several threatening letters were received from the Mahdi's people. In vain he waited at Lado for a steamer, and, on account of the disaffection amongst the natives, Emin Pasha concentrated his troops nearer his headquarters. Many letters were here received by Dr. Junker from Lupton Bey, in which the latter spoke confidently of his successes against the rebels. In one letter Lupton spoke of the advance of the Mahdi's army, and requested that, if he fell, his remembrance should be sent to those dear to him. For some months they heard nothing more of the Mahdi's forces, but once again letters reached Emin, and threatening letters were sent to various people in his province. At that time he (Dr Junker) had gone southward. In April he received news from Emin that the station of Amadi was taken, and that a part of the garrison had been killed; and, subsequently, the news was repeated, with the statement that a part of the garrison had cut their way to Makraka.

At this point Dr Junker incorporated in his address an important letter from the Mahdi, containing an account of what took place at the fall of Khartum. The letter was in tenor as follows :—

“From God's devoted servant, Mahomet Achmet-el-Mahdi, to his dear friend and representative, Keremallah Shech-el-Mahomet, Governor of the Bahr-el-Ghazal Province and Hat-el-Estiva. Receive from him many greetings and the mercy of God, the All-merciful and All-pitiful. The town of Khartum has been taken through the help of the troops of the Faith, who, early in the morning, advanced in strength. In about half an hour there befell their enemies the fate appointed for them. They were destroyed to the last man. They sought safety by entering into courtyards and closing the gates. Our army followed them, and killed them with the sword and pierced them with the lance, so that lamentations were heard loud, and weeping increased, and they were all subdued. Then they laid hold of the rest who had shut their doors from fear at the approach of harm, and took them captive ; but there remained of them only a few women and children. And the enemy of God (Gordon) was also slain. Notwithstanding that we had asked him again and again to do that which was right, he refused, and as he had lived in his crimes, so he died in them, without repentance, and was sent by our swords to the place of fire, which he had deserved from the beginning. And may the same fire consume all those who do that which is not right, and who do not follow the dictates of El Mahdi—all hail to him !—and to those who obey him, the pleasures of Paradise be for evermore.”

The Mahdists, proceeded Dr. Junker, were daily expected before Lado, but after being heavily defeated at Rimo they retreated, and Emin Pasha's province was no longer molested by their attacks.

Dr. Junker then described how he reached Zanzibar through Uganda, and in this connection took the opportunity of thanking in public the missionary Mr. A. M. Mackay, in his native country, for all the kindness he had extended to him (Dr. Junker) during the month and a half he shared his hospitality at the Church Missionary Society's station. In conclusion, he said he was sure they would all share his heartfelt wish for the prosperous and speedy issue of Mr. Stanley's expedition for the relief of Emin Pasha.

GEOGRAPHICAL NOTES.

EUROPE.

Fluctuations in the Level of the Oder.—In the *Jahresbericht des Vereins für Erdkunde zu Stettin* for 1886, E. F. Tank publishes the mean, maximum, and minimum height of the Oder, for every month from January 1818 to December 1885, as observed on the water-gauge at Stettin. The greatest difference of level on record is 277 centimètres, or 9 feet 1 inch ; the highest recorded reading was 264 centimètres of the gauge, in May 1785 ; the lowest, 13 below

the zero, in May 1843. The average annual change of level from the mean October minimum to the mean March maximum was 79 centimètres, or 31·1 inches, and the average difference of mean level from March to October was 23 centimètres or 9 inches.

For purposes of comparison the period of 68 years was divided into two of 34 years each, the first (P_1) from 1818 to 1851, the second (P_2) from 1852 to 1885. By a curious coincidence the mean water-level during the 68 years was 68 centimètres on the gauge: the mean for P_1 was 73; for P_2 , 64. The second period was characterised throughout by a lower level in the river than was the first; and it would seem worth while to inquire whether the zero of the water-gauge has not undergone some change; this, however, is not suggested by Tank.

We reproduce the table in which the results are summarised:—

Table of Readings in centimètres of Oder Water-gauge.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Mean of Lowest Water-level of month.												
Whole Period,	41	47	53	56	47	48	55	51	45	34	34	37
P_1	44	52	57	63	52	53	62	55	50	38	39	43
P_2	38	42	49	49	42	43	48	47	40	30	29	31
$P_1 - P_2$	6	10	8	14	10	10	14	8	10	8	10	12
Mean of Average Water-level of month.												
Whole Period,	64	72	81	81	66	66	71	69	65	58	62	65
P_1	64	76	86	89	72	71	77	72	69	63	66	70
P_2	64	69	75	72	61	61	65	66	62	54	57	60
$P_1 - P_2$	0	7	11	17	11	10	12	6	7	9	9	10
Mean of Highest Water-level of month.												
Whole Period,	92	101	113	108	90	90	91	90	93	87	95	94
P_1	92	105	119	117	95	99	98	92	96	95	97	100
P_2	92	97	107	99	85	81	84	88	90	79	93	88
$P_1 - P_2$	0	8	12	18	10	18	14	4	6	16	4	12

Data of this kind for the level of many continental rivers are available ; but, so far as we are aware, nothing similar has been published for any of the streams of the United Kingdom. In inland hydrography Great Britain is the least advanced of the nations.

Heights of Clouds in Summer at Upsala.—The classification of clouds in respect of form, which is used at the Meteorological Observatory at Upsala, is the following :—

1. Detached or Massed Clouds, embracing Cirrus, Cirro-Cumulus, Alto-Cumulus (Capello's Cumulo-Cirrus), and Strato-Cumulus.
2. Streamers, including Higher Cirro-Stratus, Lower Cirro-Stratus (Kaemtz's Cirro-Stratus, Capello's Strato-Cirrus), and Nimbus.
3. Clouds in rising atmospheric currents, or Cumulus and Cumulo-Stratus (storm clouds) ; these last are often surrounded by " False Cirri."
4. Elevated, scattered mist,—Stratus.

The subjoined tabular results were obtained from 1457 different measurements of 812 separate clouds, made in the summer of 1884 and that of 1885. Table I. shows the mean height of the clouds, calculated from the mean measurements of the same point in different clouds, and from these measurements the mean for each species of cloud was deduced.

TABLE I.—Mean, Maximum, and Minimum Height of Different Cloud-forms in Mètres.

Cloud-Form.	No. of Measurements.	No. of Clouds.	Height.		
			Mean.	Maximum.	Minimum.
Stratus, ...	18	13	623	994	414
Nimbus, ...	188	125	1527	3700	213
Cumulus (summit), ...	215	129	1855	3611	900
" (basis), ...	50	36	1386	2143	730
" (half-way up), ...	52	28	1507	2078	901
Cumulo-Stratus (summit), ...	18	14	2848	5970	1400
" (base), ...	2	2	1405	1630	1180
False Cirri, ...	5	4	3897	5170	2465
Strato-Cumulus, ...	165	99	2331	4324	887
Lower Alto-Cumulus (less than 4000 m.), ...	112	76	2771	3820	1498
High Alto-Cumulus (above 4000 m.)	100	56	5586	8297	4004
Cirro-Cumulus, ...	99	60	6465	10235	3880
Lower Cirro-Stratus, ...	4	3	5198	5657	4740
Higher Cirro-Stratus streamers, ...	56	25	9254	11391	6840
Cirrus, ...	373	142	8878	13376	4970

A study of these observations leads to the suggestion of a kind of law regulating the formation of clouds. Although clouds are formed at all heights, they occur most frequently between certain limits, or in certain vertical strata. The greatest number are present at 700 m. (2397 ft.) and 1700 m. (35,107 ft.).

TABLE II. gives the number of Clouds found between Different Limits of Height in Hundreds of Mètres.

Height.	No. of Clouds.	Height.	No. of Clouds.	Height.	No. of Clouds.	Height.	No. of Clouds.
2-4 ...	2	32-34 ...	11	62-64 ...	4	92-94 ...	7
4-6 ...	13	34-36 ...	13	64-66 ...	6	94-96 ...	10
6-8 ...	22	36-38 ...	17	66-68 ...	8	96-98 ...	8
8-10 ...	17	38-40 ...	5	68-70 ...	8	98-100 ...	6
10-12 ...	36	40-42 ...	8	70-72 ...	10	100-102 ...	13
12-14 ...	46	42-44 ...	14	72-74 ...	7	102-104 ...	11
14-16 ...	57	44-46 ...	5	74-76 ...	9	104-106 ...	5
16-18 ...	75	46-48 ...	8	76-78 ...	11	106-108 ...	7
18-20 ...	47	48-50 ...	9	78-80 ...	6	108-110 ...	1
20-22 ...	43	50-52 ...	6	80-82 ...	7	110-112 ...	2
22-24 ...	36	52-54 ...	6	82-84 ...	11	112-114 ...	6
24-26 ...	31	54-56 ...	8	84-86 ...	8	114-116 ...	2
26-28 ...	32	56-58 ...	5	86-88 ...	13	122-124 ...	1
28-30 ...	11	58-60 ...	9	88-90 ...	12	132-134 ...	1
30-32 ...	7	60-62 ...	7	90-92 ...	6		

The next TABLE (III.) shows the Daily Range of Altitude in the case of Cumulus and Cumulo-Stratus Clouds.

Hour.	SUMMIT.		BASE.		Difference in Mètres.
	Height in Mètres.	No. of Clouds.	Height in Mètres.	No. of Clouds.	
8 a.m.	1306	12	1087	8	219
9 a.m.	1420	6	1075	5	345
Noon.	1842	22	1266	7	576
1 p.m.	2055	42	1572	12	483
2 p.m.	2088	45	1554	8	534
5 p.m.	1758	15	1703	2	55

From this table the following three conclusions may be drawn:—(1) The altitude of the base or inferior surface of Cumulus clouds rises gradually from morning towards evening; (2) both the summit or upper surface and the thickness of such clouds attain their maxima about 1.30 P.M.; (3) the increase in the morning is relatively greater than the diminution towards evening.

The daily changes in altitude of the other cloud-formations are exhibited in Table IV. as follows:—

Hour.	NIMBUS.		STRATO-CUMULUS.		ALTO-CUMULUS.		CIRRO-CUMULUS.		CIRRUS.		CIRRO-STRATUS.	
	Mètres.	No.	Mètres.	No.	Mètres.	No.	Mètres.	No.	Mètres.	No.	Mètres.	No.
8-9 a.m.	1183	38	2012	24	3780	28	6024	24	8708	41	9687	12
1-2 p.m.	1547	62	1755	11	4259	33	6566	8	8761	29	8924	8
7-8 p.m.	2156	16	2641	56	4000	52	6227	24	9501	45	9670	26

From this we see that in general all these species of cloud-formation have a tendency to rise to higher altitudes as the day advances. That this law holds good, at least at Upsala, during the summer months, is still further borne out by

Table V., in which is given the number of clouds (except of the Cumuli) per thousand observed there at different heights, at the three hours specified in the table preceding:—

Mètres.	8-9 a.m.	1-2 p.m.	7-8 p.m.	Mètres.	8-9 a.m.	1-2 p.m.	7-8 p.m.
0. 500	34	13	0	7,000- 7,500	40	53	25
500-1,000	126	66	10	7,500- 8,000	34	27	20
1,000-1,500	91	152	25	8,000- 8,500	57	20	30
1,500-2,000	91	152	86	8,500- 9,000	86	33	21
2,000-2,500	80	99	86	9,000- 9,500	57	33	31
2,500-3,000	52	46	132	9,500-10,000	17	40	36
3,000-3,500	11	33	66	10,000-10,500	51	27	61
3,500-4,000	11	20	102	10,500-11,000	29	13	20
4,000-4,500	23	23	61	11,000-11,500	11	13	15
4,500-5,000	29	7	31	11,500-12,000	0	0	5
5,000-5,500	0	26	36	12,000-12,500	0	0	5
5,500-6,000	29	40	20	12,500-13,000	0	0	0
6,000-6,500	11	27	31	13,000-13,500	0	0	5
6,500-7,000	40	27	36				

From this tabular arrangement we perceive that the clouds group themselves in a series of ascending strata, which rise as the day advances. For instance, the lowest grouping in the morning takes place between 500 and 1000 mètres high; another takes place at noon at about 1500 mètres; and a third in the evening between 2500 and 3000. The same phenomena are repeated among the higher clouds: there is a grouping just below 9000 mètres in the morning; at about 10,000 at noon; and at nearly 10,500 in the evening. These facts seem to warrant the empirical law,—That the mean altitude of all clouds rises in the course of the day, the rise ranging up to about 2000 mètres.

A great number of observations made at Upsala during the twenty years 1865-1884 as to the frequency of the typical Cirri forms seem to justify a second law, namely this:—"In the morning, when Cirrus clouds are lowest, Cirro-Cumulus forms are most frequent; in the evening, when Cirrus clouds rise highest, Cirro-Stratus forms are most frequent."

Our last Table (VI.) illustrates the connection between the mean altitude of clouds and the meteorological condition of the atmosphere. In this table A=barometric maximum, when 168 observations were made; B=the range between maximum and minimum, with 884 observations; C=barometric minimum, 318 observations; D=equally distributed atmospheric pressure (threatening storms), 87 observations:—

CLOUD.	A	B	C	D
Stratus, ...	...	614	643	...
Nimbus, ...	...	1398	1543	2537
Cumulus { Summit, ...	1596	1979	2009	2571
or { Base, ...	1371	1457	1151	1405
Cm.-Str. { Centre, ...	1521	1465	...	1713
False Cirri, ...	...	3399	...	3897
Strato-Cumulus, ...	1540	2588	1753	2225
Lower Alto-Cumulus, ...	2304	2643	2925	3330
High "	6704	5426	4823	5206
Cirro-Cumulus, ...	(9187)	6213	6288	6873
Lower Cirro-Stratus, ...	...	5338	...	...
Higher " " Streamers, ...	...	9590	9119	...
Cirrus, ...	9184	8808	8637	10,501

It is at once evident from this that the altitude of the inferior surface of Cumulus clouds is nearly constant. Their upper surfaces, however, are lowest when the barometer stands at its maximum, rise when it stands at the minimum; and attain their loftiest reach during storms, when the imposing masses of Cumulo-Stratus clouds are some miles thick. As for the other forms, the highest clouds appear to descend lowest at periods of atmospheric depression.—N. Ekholm and K. L. Hagström in *Meteorologische Zeitschrift*, March 1887.

ASIA.

Province of Sze-Chuen, China.—The Count de Pourtalès writes as follows respecting this province and its principal trade-centres, mostly cities on the upper Yang-tse-kiang.—Shâ-Si, a city on this river, is a great emporium for the products of Sze-chuen and Yun-nan, which pass through here on their way to the maritime provinces of China. From its geographical position on the Taiping canal it commands the main trade route with Ho-nan. Here also merchandise coming from Sze-chuen for Han-Kao is transhipped from the Yang-tse-kiang to the Pu-ho canal, to be carried to Sin-tan-kao, 370 miles above Han-Kao, thus saving a distance of 620 miles. The chief objects of trade are raw cotton, cereals, and yellow silk.

Above Shâ-Si the river has a very rapid and irregular current; its bed is strewn with rocks, and the water has a minimum depth of 7 or 8 feet. Four miles above Y-chang the river entirely changes its character all of a sudden. It traverses for a few hundred miles a very mountainous region, between mountains from 2000 to 3000 feet high, over a rugged bed and between steep rocky banks. Between Y-chang and Kuei there occur numerous dangerous rapids. The town of Y-chang is situated in the midst of a country rich in a species of oil, in tea, and a little opium; and the mountainous country, a little further on, produces, in addition, iron and tobacco. Several large cities of secondary importance are situated along this part of the river, chief among which are Chung-King and Li-Ming-Fu. The former is the largest market of Sze-Chuen. It is surrounded by the river Ta-kiang (on two sides) and its tributary the Ho.

As for the province of Sze-chuen, its principal products are opium, silk, salt, sugar, hemp, oil, tobacco, coal, copper, zinc, tin, mercury, lead, iron, silver, gold, white wax, saffron, rhubarb, tea, and rice. This province itself requires large quantities of cotton and woollen stuffs. The chief obstacles to the development of its commerce are connected with the transport of goods. The river, as already stated, is extremely difficult to navigate above Y-chang.—*Bull. de la Soc. de Géogr. Comm.* (Paris), tome ix., No. 4, 1887.

AFRICA.

Tunis.—M. Philippe Thomas, who in December 1885 announced to the French Academy of Sciences the discovery of important beds of limestone in the south-west of the Regency of Tunis, has communicated (*Compte Rendu*, 9th May 1887) the existence of similar deposits further east in the neighbourhood of Kairwan, etc.

Dr. Traversi amongst the Guraghi and the Arussi.—Two important letters from this explorer, giving an account of his travels in the regions indicated, are printed in the April issue of the *Boll. d. Soc. Geogr. Italiana*. The scene of his labours lies south of Shoa, beyond the sources of the river Hawash, north and south of 8° S. lat., and between 38° and 40° E. long. Taking its broad

physical features, this region may be said to consist of an elevated tract, the Guragé (Guraghi) Mountains, which extend in two arcs south-westwards from the point where the Hawash turns east ; the plain of Maraquo, watered by the river Maki, and lying 2400 feet below the Guragé Mountains on the south-east ; a chain of three lakes—Dembel or Zuai, Hogga, and Lamina (renamed Boutourline by Dr. Traversi)—which runs parallel to the Guragé range, but south of it and somewhat *en échelon* with it ; and south-east of Zuai, another range of rugged mountains—the Sahatu (northern part) and Galama (southern)—with a north-south axis, joined at their southern extremity—the broken, precipitous peak, Uncolo Mutte,—at an acute angle by another range, the Ghedeb, which lies from north-east to south-west. Northwards from Mount Cilalu, the northern extremity of the Sahatu-Galama range, a low barren tract of volcanic formation, stretches as far as the right bank of the Hawash. From the western slopes of this same range issue the head-waters of the river Catara, which empties itself into Lake Zuai. The river Maki, which has its sources along the eastern foot of the Guragé Mountains, likewise flows into Lake Zuai. This lake is connected with Lake Hogga by a stream having the name of Suxuki ; and a second stream unites Hogga with Boutourline.

The Guragé Mountains begin with the rough knot of Soddu ; this is followed by the plateau of Nuremma, which rises at its south-west extremity into two peaks—Zebbidar and Dascinagali. These two divisions overlook the horse-shoe-shaped valley in which dwell the Guragé Aimellel, and whence issue the northern feeders of the Maki. Beyond Nuremma, the elevated region sweeps round, at about 13,000 feet above sea-level, in an arc, forming the western wall of the valley of Gogot, which gives birth to the southern feeders of the Maki. The whole of this region bears evidence of having had a volcanic origin. The eastern edge presents everywhere a steep escarpment to the plains below. Towards each extremity the surface rises ; whilst the centre seems to have been forcibly ruptured and thrust upwards by volcanic force. The Guragé Aimellel are a peaceful, gentle, and industrious race. In type they are decidedly Ethiopian, being of Amharic origin ; the language they speak is closely akin to ancient Amharic, with an admixture of Tigré words. Many of them are Christians ; the rest, who outnumber them, are Mohammedans. They cultivate the *Musa'Nsete* (which serves them for bread and potatoes, and from the leaf-fibres of which they make mats, cords, and sacking), beans, peas, cotton, lentils, barley, wheat, durrha, cabbages, and tobacco ; and they keep horses, asses, goats, sheep, dogs, and poultry.

The plain of Maraquo, which is watered by the Maki, and covered with grass and fine acacias, is inhabited by the purely pastoral Maraquo, a people with a language and customs entirely different from all the tribes around them. The Maki follows at first a south-easterly direction ; but it soon turns south, reaching Lake Zuai at its northern end. In the middle of the plain it has a width of about 14 yards, with a depth of some 18 inches. Towards the lake the plain becomes marshy, and grows very long grass.

Lake Zuai, lying 6040 feet above sea-level, contains five islands, the largest being situated on the east. The river Catara rises on the western slopes of the Sahatu-Galama range, and after a northerly course bends abruptly backwards to the south-west, to empty its waters into the north-east corner of Lake Zuai. At its embouchure it has a width of some 33 yards, a depth of 6 feet or more, and a placid current. The mountain range just mentioned is skirted on the west by the bare plateau of Albaso, 8285 feet in altitude ; through this plateau the upper waters of the Catara flow at the bottom of deep ravines. The Galama

are crossed by a pass—a deep marshy valley—10,270 feet above the sea (barometric reading 523 mm.).

The slopes of the Guragé Mountains, on their extreme south-western edge, contain many marshes, swamps, and pools, which give birth to a river called the Waira or Uaira (see vol. ii. p. 374). This has by some geographers been identified with the upper part of the Wabi-Sidama. Dr. Traversi, however, maintains that these two rivers are quite separate from one another. The Wabi-Sidama has its sources in the enclosed angle formed by the Sahatu-Galama and the Ghedeb ranges, and is reported by the Galla to reach the Indian Ocean. The Waira flows at first south-west to the country Alaba, then it turns to the south-east into Wolamo, where it probably joins a large lake which has no outlet. If it were the upper part of the Wabi-Sidama, it would have to turn to the south-east, cross Lake Boutourline, break through a lofty range of mountains, having a north-south axis, in the land of the Arussi Galla, and finally run round the Ghedeb Mountains in an almost northerly course. The southern outlet of the three lakes already mentioned probably flows for a considerable distance southwards, and finally, either alone or in conjunction with the Waira, forms one of the rivers Webi of Perthes, or else joins the Guiba (Gibié?).

Comoro Islands.—This group, situated in the channel of Mozambique, between the north-west coast of Madagascar and the East Coast of Africa, consists of the four islands—Great Comoro, Anjouan, Mohéli, and Mayotte.

Great Comoro, or *Ngasiya*, the largest of the group, measures 37 to 40 miles from NNW. to SSE., and its breadth from east to west varies from 18 to 22 miles. It consists almost entirely of a single large mountain, having a deep rift towards its centre. This mountain is an active volcano, covering an area of 1 to 1½ square miles, and attaining an altitude of 9186 feet. During eight months of the year the island receives copious rains, the clouds being arrested by its superior elevation over the neighbouring land. The population, who formerly numbered 130,000, have been diminished by frequent feuds to between 30,000 and 35,000. They are devout Mohammedans. The island has but little commerce, exporting only small quantities of timber, wooden wares, cocoa-nut fibres, and copra, and importing cloth, fire-arms, gunpowder, flour, soap, cutlery, pottery, etc. What trade there is, is in the hands of Arabs and Hindus.

Anjouan, or *Johanna*, lies about 50 miles south-east of Great Comoro. It is very hilly, having several elevated peaks, the highest of which attains 6560 feet; and numerous small deep valleys, watered by mountain torrents. The summits of the mountains alone are wooded. Two lakes fill up former craters. Mineral waters exist. Malarial fever prevails in the lower tracts. The population, which is very mixed, consists of Arabs, Malagasy, and Negroes, and numbers some 12,000 to 15,000 persons. Like Great Comoro, Anjouan has no port, only good roadsteads. Three sugar refineries are at work in the island. The natives cultivate coffee. The objects of trade are much the same as in Great Comoro.

Mohéli, or *Mohilla*, situated 35 miles south-east of Great Comoro, measures about 15½ miles long by 11 broad, and consists of a number of rounded knolls (*mamelons*), superposed one upon another, the highest not rising to more than 2625 feet. The island is well watered, and, though not so plentifully timbered as the other members of the group, is not less fertile. There is a good harbour for vessels of small tonnage. The population does not amount to more than 3000 or 4000, nearly all Malagasy and Negroes. Mohéli, too, has a sugar-refinery; and mats are made from palm leaves.

Mayotte.—This island has been French for forty years ; its length is 27 to 30 miles, and its breadth about 14. The highest point reaches 2230 feet. It has numerous small streams. The population numbers some 12,000 to 15,000 persons. Mayotte is the most malarious island of the archipelago, owing to the great number of reefs and marshes. It possesses, however, several excellent bays, roadsteads, and ports. Much sugar and rum are manufactured. Coco-nuts are grown in large quantity, and rice is now cultivated.—*M. L. Humblot in Bull. de la Soc. de Géogr. Comm.* (Paris), tome ix., No. 4.

[With this notice of Mayotte by *M. Humblot*, one of the pioneer colonists of France in Madagascar, compare the in some respects divergent account by *M. de Lanessan*, in vol. iii. p. 104.]

Diégo Suarez.—The bay of Diégo Suarez, opening a little to the south-east of Cape Amber, the northern extremity of Madagascar, is a large basin affording at all seasons a safe and accessible anchorage. Its entrance is protected by two small islands—Clarence and Aigrette—and Cape Diégo. This part of Madagascar lies outside the region of cyclonic visitation. The water obtainable on shore is good and abundant. The climate is tempered by the constant sea-breezes, and is agreeable even in the season of strong winds—May to November. Malarial fevers prevail on the low marshy portions of the bay, but out in the roadstead and on the more elevated parts of the shore, the sanitary conditions compare very favourably with other coast districts of Madagascar. The place boasts of nothing at present except cattle, fish (the latter in considerable quantity), and the produce of the chase (guinea-fowls, wild boars, partridges, quails, turtle-doves, ducks). A scorpion, a black butterfly, large bats, and numerous but harmless reptiles, are the other chief wild creatures. Of natural productions there are said to be good marble, building stone, clay, and some iron and copper. Traces of turf and coal are reported to have been detected. Several species of useful timber exist in the forests, especially ebony, rosewood, and creepers yielding caoutchouc.—*Captain Chodzco, in Bull. Soc. de Géogr. Comm.* (Havre), Jan.-Feb. 1887.

River Kuanza, in Loanda.—*M. Châtelain*, a Swiss missionary, belonging to the Loanda Mission, started from the town of Loanda on 1st January last to ascend the river Kuanza. Passing on his way the agricultural station of Bom-Jesus, which has two large sugar plantations, he reached Dondo, the centre of a district having some mineral resources, such as sulphate of magnesia, iron ore, bituminous coal, antimony, and a kind of potash which serves as a substitute for soap in ablutions. None of these are, however, worked. Each bank of the river, all the way from Dondo to Nhangué, is characterised by fine Alpine scenery ; and near the latter place the stream descends in a magnificent waterfall, broken by rocks into six sections, and is received into a deep caldron, above which ever-changing rainbows glisten in clouds of spray. From Nhangué a sinuous pathway leads to Malangué, traversing an elevated plateau, with an undulating contour, which affords excellent pasturage for the herds of native cattle. *M. Châtelain* arrived at Malangué on 28th February.—*Le Mouvement Géographique*, 8th May 1887.

The Rivers Sekoli, Licuala, and Licon.—The *Mouvement Géographique* of 5th June gives some further account of the expedition undertaken by *M. Jacques de Brazza* and *M. Péçile* (see vol. ii. p. 684) into the unknown country to the north-east of the Ogowé. It is there maintained that the Sekoli is really the Licuala, of which the famous Licon is but a right-hand tributary, and which was ascended by *M. Massari*.

Dr. Ludwig Wolf's Explorations in the Congo Basin.—Dr. Wolf was a member of the exploring party sent out in 1883 at the expense of the King of the Belgians, but under the German flag, and under the leadership of Lieutenant Wissmann, for the purpose of exploring the Kassai and its mouth. Some account of the admirable work done by the members of this expedition has been already given in our pages (vol. i. pp. 192-3 and pp. 573-5). To Bd. xiv. No. 2 of the *Verhandl. d. Gesellsch. f. Erdkunde zu Berlin*, Dr. Wolf has contributed a general survey of his own labours in connection with the expedition. From this the following particulars are reproduced:—

The Baluba, the people in whose country the Luluaburg station is situated, kept themselves, until about fifteen years ago, strictly separate from their neighbours. They had the repute of being warlike cannibals, like the Bakutu in the north-west, and lived in a state of chronic discord amongst themselves. At the period indicated, the younger men of the nation, headed by their chief, Kalamba Mukenge, and his brother and sister, conceived the desire to break down the barrier of exclusiveness by which they had hitherto hemmed themselves in. This project of establishing relations with their neighbours and of opening up their country to the emissaries of commerce was, however, so repugnant to the old men and greybeards of the Baluba, that they took up arms to resist the dangerous reforms. The result was the strange spectacle of a civil war between the young men and the old men of the nation, in which the latter were worsted, most of them, as well as their women, being either slain, or drowned in the Lulua. This people possess qualities and characteristics which would render them adept pupils in learning the arts of civilisation.

North-west of the Baluba, between the rivers Lulua and Sankuru, lies the country of the Bakuba. This people, again, who, both in language and in customs, differ from the Baluba, abstain jealously from all intercourse with their neighbours. Dr. Wolf describes them as typical examples of fine powerfully-built savages. Their toe and finger nails, as well as their waist cloths (woven by themselves from the fibres of the palm), they stain red. On reaching the age of puberty, the males have their two upper incisors knocked out. Out of the palm fibres, they also make cloth and mats of some artistic pretensions. Their weapons, too, exhibit evidence of great care and artistic dexterity. Their villages are regularly laid out, with well constructed dwellings, and straight streets and broad open spaces. The cultivated ground is carefully kept, and enclosed patches, like gardens, are often seen in the vicinity of the villages. All agricultural labour is performed by the women.

The country of the Bakuba, and of their tributaries the Bakete, is separated from that of the Baluba by extensive primeval forests, and is thickly inhabited. In general, it may be described as undulating and hilly, and is traversed by several small streams. The soil, which is fertile, consists in the main of black humus and reddish yellow loam. The principal natural productions are manioc, maize, sugar-cane, ground-nuts, and millet, with bananas and pine-apples. Palms flourish in great luxuriance, especially the oil-palm. Of domestic animals, the people possess goats and poultry. Elephants, buffaloes, wild pigs, antelopes, and apes, as well as guinea-fowls, are very numerous.

The original inhabitants of this region are said to have been the Bakua, of the African dwarf race. Both the Bakuba and the Baluba are immigrants into the localities they now occupy, the former having come from the north-west, but the latter from the south-east. The Bakua, who were conquered by the Bakuba, still exist in a few scattered settlements, some of which Wolf visited. These people varied in height from 4 feet 6 inches to 4 feet 7½ inches in one

village, and from 4 feet 3½ inches to 4 feet 4 inches in a second. They live solely by the produce of the chase. Their weapons consist of bows, arrows, spears, and knives.

Dr. Wolf then traversed the Lulua and the Kassai, down to the confluence of the latter with the Congo at Kwamouth (see vol. ii. pp. 573-5); and after that ascended the Sankuru (early in 1886). This river and the Kassai, for a short distance before uniting their waters, flow together nearly parallel in a WNW. direction, their conjoint breadth approximating to 4370 yards. But a little further east the Sankuru comes from the north and the north-east, whereas the Kassai comes from the south and south-east. The right bank of the former consists, near the confluence, of a steep wall of laterite, 65 feet high. The country behind is an open savannah, with groves of trees, clumps of bushes, and strips of primeval forest. Further up, the river averages sometimes 2200 to 3280 yards in width, and has a mean depth of between 9 and 10 feet. Its course is often very sinuous. The riverine tracts present alternately forests with luxuriant palm groves, and open, apparently boundless, expanses of grass. The water of the Sankuru has a pronounced clayey tinge; whereas that of its smaller northern affluents (except the Lomani) are of a deep black colour. It contains rich supplies of edible fish, of very many different species. Hippopotami are very plentiful, as also crocodiles. A veritable plague along the middle Sankuru were the mosquitoes, which are of great size and very blood-thirsty.

Up to the confluence of the Lubi, the river was thronged nearly everywhere with large canoes, full of oarsmen. As far as 23° E. long. the inhabitants of the right bank are Bankutu, and therefore belong to the Bassongo Mino; then follow the smaller tribes of the Bashobbe and the Butoto. The left bank is peopled by Bakuba. On reaching 4° S. lat. the fan-palm (*Borassus*) became frequent, as it is on the Kassai in the same latitude: the baobab also was not met with beside either river north of 3° 41' S. lat.

The Bassongo Mino are in person tall and slim, a decided contrast to the powerful low-sized, broad-shouldered Bakuba, and are dreaded by all their neighbours as cannibals. They themselves deny this, and Dr. Wolf detected nothing amongst them to justify the charge. As tribal badge or peculiarity, they have the upper and lower incisor filed to a point (*mino*=teeth). Above the junction of the Lubi, the Sankuru is known as the Lubilash, and from that point becomes dangerous for navigation, even in canoes. The river-bed, which hitherto had consisted generally of clay, now became stony; whilst the stream was contracted by steep walls of laterite and sandstone, 330 to 650 feet high, to a current having an average depth of about 10 feet and a velocity of nearly 4½ miles per hour. From 6° S. lat. numerous cataracts and rapids prevent progress by water. At Batondoi, a village of the Baluba, who stretch thus far eastwards, the Lubilash narrows to only 27 yards in width, with a velocity of 5½ miles per hour.

After exploring the Lubi—a left-hand tributary of the Sankuru, averaging from 45 to 55 yards in width and about 6½ feet in depth—the expedition commenced the return journey down the stream. Dr. Wolf then discovered the mouth of the Lomami, which in two arms joins the Sankuru from the right. This river, from 90 to 110 yards wide, and with an average depth of 6 to 10 feet, has water of a clay-brown colour, and densely wooded banks, which rise to 660 feet. Its general direction is first north, then north-west; at its mouth it is called by the natives “Luetshu.” The Kassai, Sankuru, and Lomami thus constitute an almost direct waterway to the east, into the interior of Central Africa, 780 to 790 miles in length.

Dr. Wolf, in conclusion, calls attention to the important fact that beyond the latitude of about 5° S. the beds of all the rivers—the Congo, Kuango, Kassai, Luebo, Lubi, and Sankuru—are stony, and cataracts are formed.

The Ubangi and its Affluents.—Between 12th October and 4th December 1886 this important river, as well as some of its affluents, was ascended by Captain Van Gèle on board the *Henry Reed*, having been specially commissioned to do so by the Government of the Congo Free State. His trip fell in the season of floods or high water. The river was nowhere found to have a less depth than 6 feet, or a greater depth than 36 feet. The breadth of the river above a French post established on its left bank, in 0° 8' 30" S. lat. and 17° 35' E. long., measured approximately 2730 yards; its depth was 36 feet, and its velocity about 2½ miles an hour; this, allowing a mean depth of 6½ feet, gives a volume of 524,630 cubic feet per second. At lat. 4° S. its breadth is 1310 yards, its depth 24½ feet, and its velocity nearly 2½ miles per hour. Assuming a mean depth of 13 feet, this gives a volume of 217,640 cubic feet per second. The waters of the Ubangi are of a clear brown colour. Its banks are generally wooded and its bed studded with islands. On the right bank, however, there are several marshy tracts; whilst the left bank is often elevated and bordered by chains of hills.

In the upper part of its course, south of the 4th parallel, the Ubangi has but three small tributaries—the Nghiri from the left, and the Ibenga and Lobay from the right. The first named, which debouches into the Ubangi about 30' north of the Equator, waters the peninsula which is wedged in between the Congo and the Ubangi. This peninsula, as far as 1° 20' N. lat., consists of a valley from 3½ to 6 miles wide, studded with a succession of large ponds having numerous little islands, and down it serpentine the Nghiri with a feeble current. At its confluence this stream is about 110 yards wide and 17 or 18 feet deep. The *Henry Reed* ascended as far as 1° 20' N. lat., where the river, still nearly 10 feet deep, splits into a number of small channels, which emerge from a swampy forest. Along the navigable part of the Nghiri, a distance of 105 miles, the population is exceedingly dense, both banks and the islets being full of villages embowered amidst bananas and palm-trees. The white travellers were everywhere hospitably received. A little north of 2° N. lat., the Ubangi is joined by the Ibenga (the Botabo of Grenfell), which at its confluence measures nearly 100 yards in width, 17½ feet in depth, and has a velocity of 1½ mile per hour. Its water is black; it comes from the north-north-west, and has low banks. The Lobay, a more important affluent than the Ibenga, joins the Ubangi in about 3° 40' N. lat., where its width is nearly 220 yards, its depth 17½ feet, and its velocity nearly 1½ miles per hour. Its water is a little darker in colour than that of the Ubangi. Its banks, which are wooded, have in some places an elevation of 30 feet or more. At a distance of 40 miles above this confluence the *Henry Reed* was stopped by a fall 3 to 4 feet in height.

Below 4° N. lat. the Ubangi, coming from the north-east, pierces a mountain chain whose axis lies from north-west to south-east, and which has on its south side peaks with an elevation of 650 to 800 feet above the level of the river. In this gorge, called the rapids of Zongo, the river contracts to 875 yards, and is divided into five sections by an island and three masses of rock. The main body of the stream is forced through a passage 270 yards wide, almost in the middle of its bed. This point the *Henry Reed* was unable to pass; but Captain Van Gèle and one of his companions, Lieut. Liénart, proceeded about a mile and a half further on foot along the left bank. Above the rapids the river is divided into two channels by a line of rocky islands. The natives call the river the Ibali and

Dua; but Liboko, the name given to it on its first discovery, was nowhere heard.

The left bank is much more densely peopled than the right bank. The latter is inhabited by the Baloi, a race of pirates, the terror of their neighbours, who carry on their predatory excursions as far as the Congo; they also traffic in ivory. They have the practice of tattooing five small-sized pyramids on their forehead, consisting of superimposed horizontal lines. On the left bank are the countries of the Baati, Monyembo, and Montumbi. The Baati are a fine race, of tall stature, the medium height of the men being nearly 6 feet, which is also attained by several of the women; they are broad-chested, have a superb muscular development of arm, and are but little tattooed. The four upper incisor teeth are generally absent. Cannibalism is practised everywhere in this part, all those killed or captured in war being devoured. Beyond the region inhabited by the Baati the language changes entirely, and at the same time various articles made of ivory are met with. Generally in the morning, the river Ubangi, in this the upper part of its course, presents a scene of unusual animation. The traveller may often meet between 200 and 300 canoes carrying the women and children to the fields, and bands of armed warriors to defend them.—*Le Mouvement Géographique*, 8th May 1887.

Central Africa.—A supplement to *Science*, dated May 27th, 1887, is devoted to short sketches of the political and physical geography, and the people and vegetation, of Central Africa. A rapid review of the history of African exploration in the Congo basin and of the settlement, by the European powers concerned, of their respective spheres of interest in both East and West Africa, is followed by a few short notes on the principal Negro kingdoms, such as that of Muata Yamvo and Mwanga (Uganda). Then comes a sketch of the chief physical features which characterise this part of the Dark Continent, combined with some notice of the influential part played by the meteorological phenomena,—rainfall and prevailing winds. The last two sections treat of the ethnology and vegetation.

AMERICA.

Charleston Earthquake.—A "Supplement" to *Science* of 20th May 1887 is mainly devoted to an "Abstract of the Results of the Investigation of the Charleston Earthquake," by Messrs. C. E. Dutton and Everett Hayden. These gentlemen write—"The area within which the motion was sufficient to attract the attention of the unexpectant observer would be somewhat more than circumscribed by a circle of a thousand miles radius; and the area of markedly sensible shaking would, including the oceanic area, be somewhere between two and one-half and three million square miles. In this estimate, however, only well-defined seismic movement of notable force is considered." Mountain ranges are generally believed to act as barriers to the propagation of seismic phenomena. In the case of the Appalachians, the nearest range to the centre of the Charleston earthquake, it does not appear that they "offered any sensible barrier to the progress of the deeper waves, but it does appear that they affected in a conspicuous degree the manner in which the energy of the waves was dissipated at the surface. . . . Where the waves passed into the newer delta region of the Lower Mississippi, the surface intensity of the shocks rapidly declined. We incline to the opinion that this sudden diminution of the intensity is due to the dissipation of the energy of the waves in a very great thickness of feebly elastic, imperfectly consolidated, superficial deposits." And the similar con-

formation of the entire coastal region of the Carolinas will account for the fact that the calamity there was not of a more portentous magnitude than that which actually occurred. "Throughout the States of North Carolina, South Carolina, Georgia, and north-eastern Florida, and in general anywhere within about 250 miles of the centre, the energy of the shocks was very great." And the nearer the centre of seismic disturbance the greater was their intensity. The central scene of the outbreak was studied with a considerable amount of pains and care by Mr. Earle Sloan of Charleston. His summary is to the following purport:—"The tract which includes the most forcible action of the earthquakes is an elliptical area about twenty-six miles in length, and with a maximum width of about eighteen miles. The major axis of this area is not a straight line, but a curve, which is concave towards Charleston, and is situated from fourteen to sixteen miles west and north-west of that city. Along this line there are three points, each of which has all the characters of an epicentrum, determined by as many distinct shocks, each having a focus of its own. Much the most powerful shock centres in the northernmost focus, though the other two were of sufficient energy to have occasioned great havoc if either of them had occurred alone. The southernmost was also considerably more energetic than the middle one. The distance between the northern and southern epicentrum was about twelve miles. Within this tract, except near the edges of it, the motion was most conspicuously of subsultory character, *i.e.* motion in which the vertical component predominated over the horizontal. The marginal portions of this area, where the character of the movement changes, and where the intensity falls off most rapidly, seem to be very well indicated. The positions where the intensity most rapidly declines may be located with an error not exceeding one or two miles on both sides of the epicentres." With respect to the duration of the earthquake at Charleston, the general consensus of scientific opinion puts it between 50 and 90 seconds. In respect of places at less than 600 miles' distance from Charleston, it seems that the speed of propagation of the shocks varied from 3.02 to 3.74 miles per second.

Costa Rica.—The total population of this State at the census of 30th November 1883 was 182,073, which by the end of 1885 had increased to 193,144. Distributed according to the provinces of the Republic, the population at the former date was divided as follows:—San José, 56,162; Alajuela, 45,205; Cartago, 30,428; Heredia, 25,818; Guanacaste, 14,902; Puntarenas, 7700; Limon, 1858. The bulk of these (180,384) are Roman Catholics. 6787 were engaged in agriculture. The schools were attended by 8322 pupils, who were taught by 136 male and 105 female teachers. Of the total population, 21,391 could read, and 26,759 read and write. In 1885 the province of San José had 59,702 inhabitants, that of Alajuela 49,825, of Cartago 32,247, Heredia 27,752, Guanacaste 15,652, Puntarenas 8092, and Limon 1874. The number of children within school age amounted to 32,306 (17,026 boys and 15,280 girls). There were 216 public primary schools (115 for boys, 101 for girls), which were attended by 13,413 pupils.—*Zeitschr. d. Gesellsch. f. Erdkunde zu Berlin*, Bd. xxii., Hft. 2.

M. Coudreau and Guiana.—This traveller, who has been charged by the French Government with a special mission to the scene of his previous labours, delivered recently, on the eve of his departure from France, an address on French Guiana before the Geographical Society of Tours. Respecting this colony, he uses the significant words: "Guiana! Guiana no longer exists; it is a country to be despaired of, a hotbed of fever. The flora consist only of poisons, the fauna only of serpents. It is a perplexing puzzle, a dead colony." He cherishes the

idea of the formation of an Amazonian confederation under the protection of France, to consist of French Guiana and the two Brazilian provinces of Amazonas and Para, in which he states that there is a French party not averse to some such scheme. The mission with which the traveller is charged is not, however, political, but, as he affirms, purely scientific. His special aim is the exploration of the Tumuc-Humac chain, which Dr. Crevaux traversed but did not study.—*Revue de Soc. de Géogr. de Tours*, February 1887, and *Compte-Rendu*, Paris Geog. Soc., No. 9.

Signor Ramon Lista.—This gentleman has returned from his expedition to Tierra del Fuego. On his arrival in the Bay of San Sebastian, on 15th November 1886, the entire country was covered with a luxuriant vegetation. Indeed, with the exception of the mountains and certain arid points on the coast, Tierra del Fuego possesses much pasture-land of great fertility, as well as abundant forests. He is of opinion that hail hardly ever falls in that region, owing to its extreme humidity and the prevalence of certain atmospheric currents.—Communicated to *Compte Rendu*, Paris Geog. Soc., No. 9, by M. Henry l'Huissier of Buenos Ayres.

OCEANIA.

New Hebrides.—A few general facts relating to these islands may not be unwelcome to our readers. The archipelago, nearly 350 miles distant from New Caledonia, consists of a long chain of volcanic islands, extending for about 450 miles between 10° 10' and 20° 10' S. lat., and between 166° and 172° E. long. The approach to land is rendered nearly everywhere difficult by girdles of coral reefs. The largest island of the group is Espiritu Santo, about 90 miles long by 50 broad; it has a fine bay on the north-east. The next largest is Mallicolo, 58 miles long by 30 broad. Erromango is 32 miles long and 23 miles broad. Tanna, Vate (Sandwich), Pentecost, and Aurora, with a multitude of smaller islets, complete the list.

All the islands, owing to their volcanic formation, bear much resemblance to each other. They consist of a series of bare terraces, connected by easy wooded slopes. The general direction of these elevations is north-east, and their height varies from 330 to 3300 feet. The plateaux are clothed with Guinea grass and couch-grass, and numerous low *Leguminosæ*. The axis of eruptive agency is shown by the active volcanoes of Tanna, Api, Ambrym, etc. The soil of the alluvial plains at the foot of the hills is composed of rich volcanic earth, containing disintegrated coralline and vegetable matter, and is of great fertility. A net-work of little streams covers nearly every island. The steep irregular coasts are deeply indented, forming numerous bays and commodious harbours, accessible at all times, and protected against ocean and wind by coral reefs or breakwaters. One of the most important of these harbours is Port Havannah, on the north of Vate (Sandwich), standing on the shores of an almost landlocked basin nearly 7 miles long by 1 to 2 broad.

All the vegetables and fruits native to this region of the tropics grow here in profusion. Of the latter we may mention the plantain, banana, papaw, bread-fruit, nuts, almonds, coco-nuts. The only native animal is a small rat. But the horse, ox, sheep, goat, and poultry have been introduced, and readily adapt themselves to the climate. The birds include brilliant parroquets, pigeons, turtle-doves, and some songsters. The only reptiles are water-serpents and lizards. There is scarcely any insect life.

The indigenous population seem to come from the same stock as the natives

of the south and west of New Guinea. Their physical characteristics point to a Papuan origin; but they are evidently a cross between the Polynesian and Melanesian types. They stand at a very low level in point of civilisation, the chief occupation of the men being war, whilst cannibalism is largely practised. Several different dialects are spoken throughout the archipelago. This noteworthy fact is however recorded of them: there does not exist a single thief on all the islands of the group.—*M. E. Polliart in Bull. de la Soc. de Géogr. Comm. (Paris), tome ix., No. 4.*

MISCELLANEOUS.

On 31st December 1886 the population of **Stockholm** numbered 223,063, being an increase of 7375 in the course of the year.

Dr. Labonne left Cherbourg in April on a new exploring trip to **Iceland**, where he will resume his study of the volcanoes and glaciers.

A **New Geographical Society** has just been founded in France, namely at Toulon, under the presidency of Admiral Krantz, and vice-presidency of the Mayor of Toulon.

Early in June **MM. Bonvalot, Capus, and Pepin** arrived at Chitral from over the Hindu-Kush in a destitute condition, having been robbed of all their possessions on the way. The Government of India, on learning the facts of the case, at once sent aid to the travellers to enable them to reach India.

M. Chaffanjon, writing from Ciudad Bolivar, in Venezuela, on 19th March, announces that he has succeeded in reaching the sources of the Orinoco. These he found to lie within the outspread arms of a chain of mountains, to which he has given the name of Ferdinand de Lesseps Mountains. He next intends making a reconnaissance from Caura towards the sources of the river Essequibo, and to return by way of the mines of Caratal.

The Government of India, prompted by the authorities of the Royal Gardens at Kew, are about to initiate a **Botanical Survey** of the whole of India. For this purpose the country will be divided into four sections; the first of which will be under the direction of Mr. J. F. Duthie, Superintendent of the Government Botanical Gardens at Saharanpur, the second under Surgeon-Major G. King, Superintendent of the Royal Botanical Gardens, Howrah, and the third and fourth under the Madras and Bombay botanists respectively.

NEW BOOKS.

Pioneering in New Guinea. By **JAMES CHALMERS**. London: The Religious Tract Society, 1887. Price 16s.

It may be safely affirmed that no man living knows so much about British New Guinea as James Chalmers. For a considerable number of years he has made it his home, if home a man can be said to have who is almost uninterruptedly on a journey by land or by sea. With Port Moresby as a base, the London Missionary Society have pushed their outposts further and further eastward and westward along the coast; and of this noble work Chalmers, in the little *Ellangowan*, has been the most enthusiastic and indefatigable pioneer, founding new stations, visiting the older ones to cheer and stimulate the teachers,

supervising generally the whole, and keeping them all in touch with one another and with the base. A unique position of this kind gives a man exceptional opportunities, and he who can fill the position worthily, as Chalmers has unquestionably filled it, becomes almost without effort a recognised authority on the country in which his lot is cast. *Pioneering in New Guinea* is thus certain to be eagerly welcomed. The only fear is that some people may come to it with too high expectations, and be a little disappointed. The author himself has apparently foreseen this possibility, and wisely gives a word of warning to his readers at the very outset. "This volume," he says, "contains sketches of travels and labours in New Guinea during the years 1878 to 1886. The author has made no effort to work them up into a finished book. Had he attempted to do so, they would never have seen the light. He is more at home in his whale-boat off the New Guinea coast than in his study, and his hand takes more readily to the tiller than to the pen. Hence the bulk of this volume is made up of journals somewhat hastily written while sitting on the platforms of New Guinea houses, surrounded by cannibals, or while resting, after a laborious day's tramp, under a fly-tent on some outlying spur of the Owen Stanley Mountains, or while sailing along the south-eastern coast in the *Ellangowan*."

The book consists of fourteen chapters, the thread of connection being, as the author implies, very slight. Six of them may be classed as more or less descriptive of travel, viz., "A Trip to Oiabu and Mekeo," "Among the Cannibals of the Gulf," "Peacemaking at Kabadi and at Gubele," "Two long Inland Tramps," "Trips on board H.M. Ships *Raven* and *Dart*," and "Pioneer Mission Work in 1884." The most important of the six are the second and fourth, that in regard to the cannibals of the Gulf being exceptionally interesting. Three other chapters deal almost entirely with the natives, and all three are very readable and instructive. One of them takes the form of answers in parallel columns to 115 questions regarding the customs and beliefs of the Motu and Motumotu tribes; another consists of sketches of ten New Guinea celebrities; and the third is a collection of six sketches on sorcery, feasts, and other less important matters. Of the remaining five chapters, one tells of tribal wars, another of the preparations for the native trading voyages, and three concern the relations of the British Government with the natives. The last three add little to what has been already told by others.

The style of writing is lively, graphic, and somewhat discursive. The geographer in search of accurate information regarding the topography and natural features may find it tantalising, but there is a certain charm about it that would make him hesitate to find fault. The keynote of the whole book is the author's enthusiasm for his work as a missionary pioneer. Whatever subject he may be concerned with, his interest in the natives is constantly uppermost. The consequence is that the book is stored with information about New Guinea ethnography and folk-lore, and is a little wanting in scientifically accurate geographical details. A German explorer on the north-east of the island, having effected scarcely a tithe of Mr. Chalmers' explorations, would have produced a carefully-drawn map of the country bordering on his route, would have told us of the breadth and depth of the rivers and the heights of the mountains, and would have indicated the general character of the soil and its products. How fertile, for example, when treated in this way, would have been Mr. Chalmers' two notable journeys told of in the chapter headed "Two long Inland Tramps"! It is foolish, however, to wish Mr. Chalmers different from what he is, and it would be extravagantly exacting to expect more of him when he has so many distinguished qualities, and has brilliantly accomplished so much. As a pioneer

of the London Missionary Society he has had few equals, and geographers should have nothing but admiration for his noble character and deeds, and gratitude to him for advancing their work along with his own.

The map accompanying the volume is that which appeared in the February number of the *Royal Geographical Society's Proceedings*, and is anything but satisfactory, at least in its present connection. Dozens of place-names occur in the text which do not appear on the map, and in many instances the geography of the map is at utter variance with that of the text. Some of these latter instances are very glaring. On page 150 the reader is told that "after leaving Sogeri we travelled towards Moroka for some distance until we came on the sources of the Kemp Welch, which falls into Hood Bay, when we turned more easterly still, and came to Favere." On turning to the map he learns that it would be equally accurate to say, "After leaving Peebles we travelled towards Edinburgh for some distance until we came on the sources of the Nith, which falls into the Solway, when we turned more easterly still and came to Dumfries." The whole of page 151 is almost equally mystifying when taken in conjunction with the map. An accurate map on a tolerably large scale, and embodying all that is at present known about British New Guinea, is a desideratum, and if copies of such a map were placed in the hands of intelligent whites resident in the country, for the purpose of obtaining from them corrections and additions, much reliable information might be collected.

The illustrations by Whympers are numerous and excellent, and, being produced from photographs, are more than ordinarily valuable.

Australian Defences and New Guinea. Compiled from the Papers of the late Sir Peter Scratchley, R.E., K.C.M.G. By C. KINLOCH COOKE, B.A., LL.M., Barrister-at-Law. London: Macmillan, 1887. Price 14s.

In 1860, Captain Scratchley was directed to proceed with a detachment of engineers to Melbourne for employment on the colonial defences. His exhaustive reports on the best system for protecting the weak points of the coasts of our Australian colonies no doubt formed the basis of the discussions at the late Colonial Conference. Briefly stated, the opinion of Sir W. Jervois and Sir Peter Scratchley, aided by the advice of Admirals Hoskins and Wilson, was that, in the event of this country being involved in a great European war, it would be necessary to protect certain towns and coaling stations from a possible attack, by a squadron consisting of three or four vessels, one or two of which might be ironclads, and capable of landing a force of 1200 or 1500 men. To meet such an emergency, it was recommended that the present squadron in the Australian waters should be strengthened so as to be better able to watch the great extent of coast; that the principal towns and coaling stations should be protected by gunboats and torpedo launches, or by fortified posts; and to prevent a landing party of the enemy's squadron attempting the assault of any of the towns, local levies of engineers, field artillery, and riflemen should be raised. This report ought to prove interesting reading, especially to naval and military men, giving as it does detailed schemes for the defence of twenty-four harbours, towns, or coal depôts on the Australian and New Zealand coasts.

The most interesting portion of the book to readers of this Magazine will be that bearing on our new colony—New Guinea. In November 1884, when General Scratchley was appointed Her Majesty's Special Commissioner, the instructions issued to him prove that either Lord Derby misled the Colonies, or Prince Bismarck misled Lord Derby with regard to New Guinea. On arriving

at Albany from England, the news of the German annexation reached the General. Public opinion ran very high in the Colonies against the Home Government when the German annexation followed within six months of Lord Derby's assurance, "that Her Majesty's Government are confident that no foreign Power contemplates interference with New Guinea."

General Scratchley landed in Melbourne in January 1885, but his preparations for reaching New Guinea were impeded by the imperial authorities failing to provide him with a steamer to enable him to make the acquaintance of the country, its harbours and general features; and it was not till the end of August that he at last reached Port Moresby in the *Governor Blackall*, a steamer hired in Sydney, to serve as "Government House" for the Commissioner and his staff. From this time till his last fatal illness on the 9th of November, a private diary, intended only for his wife's perusal, gives a plain unvarnished account of his daily work; interviewing chiefs, settling land claims, investigating murders of Europeans, and making useful inquiries as to the capabilities of the new territory, manners and customs of the people, and arranging for a rough and ready administrative machinery. He gratefully acknowledges the kindness and invaluable assistance he received from the missionaries Messrs Chalmers and Lawes, and speaks in high terms of the native teachers, chiefly Samoans, who are located at intervals all along the coast, in forty different stations. Owing to these missionaries, communication has been opened up, not only along the coast-line, but far into the interior, and a white man can travel fifty miles inland quite unarmed. Sir Peter Scratchley considered "the blacks are easily met by firmness, justice, and caution," and says, "I am more than ever convinced that all the outrages are justifiable. I have heard horrible stories about the doings of the whites, and, please God, I shall let the light of day into them. A righteous cause I am engaged in, and that gives me zest in working it." In the last entry in his diary, writing of the natives of Discovery Bay, he says: "All the population was very friendly." Two days later, the 21st November 1885, he was seized with an attack of fever, and died on the 2d of December.

The Rev. Mr. Chalmers thus speaks of him: "The General was a grand man; I loved and trusted him. Poor New Guinea has lost a true and loyal friend, and one in whose hands native interests were safe. The General did too much hard mental and physical work." And we may add, he greatly over-estimated the healthiness of the climate.

Shores and Alps of Alaska. By H. W. SETON KARR, F.R.G.S. Pp. xiv. + 248. London: Sampson Low and Co., 1887. Price 16s.

There is not a little evidence that the coasts of British Columbia and Southern Alaska will, in the near future, more and more attract the attention of tourists, sportsmen, and explorers. The facilities afforded by the Canadian Pacific Railway and the steamers of the Pacific Coast Company, the impressive grandeur of the scenery along the route of the railway from Calgary westward, the magnificent island views of the long pleasure sail by the Inland Passage, the lofty unscaled peaks and extensive glaciers of the St. Elias Alps, the abundance of fish and game, all conspire to withdraw the roving Anglo-Saxon from more beaten paths. A great incentive will also be found in the book before us, which we trust will serve to whet the appetite of many readers, and thus lead to a rapid ingathering of information regarding an exceptionally interesting district of the earth's surface.

Mr. Seton Karr's journal separates itself naturally into three parts:—the

first, consisting of the Introduction and Chapters I.-III., takes us from Montreal to the foot of Mount St. Elias; the second (Chapters IV. and V.) relates the story of the attempted ascent; the third, amounting to about half the book, is devoted to a coasting voyage westwards, and to the details of a two months' stay at Nuchuk in Prince William's Sound.

The interest of geographers will at once be drawn to the second part. It is an excellent popular account of a notable little bit of good geographical work. Although the top of Mount St. Elias was not reached, important knowledge of the mountain was gained, which will prove most valuable to those who make the next attempt. Almost equally interesting and instructive are the chapters written in the neighbourhood of Prince William's Sound. One passage may be given illustrative of the superabundant supplies of salmon there obtainable:—

"More surprises were yet in store. A small brooklet, but a yard wide and three inches deep, trickled from the woods across the beach. It was completely crowded with salmon, and, the water being not of a depth to cover them, their backs were bare. . . . As I approached, their wriggling and splashing almost emptied the pools of the little water that existed in them, in their efforts to find shelter in the deeper water that did not exist. . . . I followed the brook some twenty yards up its course, until fallen trees and damp bushes turned me back, and everywhere the surface was a mass of the moving and swaying backs of the foolish fish—the lordly salmon in water hardly deep enough to harbour a minnow."

The book, as a whole, may be commended as very pleasant reading—light enough for a reader on a holiday, and yet full of information from beginning to end. One gets from it admirably clear ideas of the places and peoples visited, and the getting is accomplished with little or no effort—no more effort than is necessary in listening to the talk of an agreeable, educated companion.

There is a profusion of clever illustrations, and a sufficiency of well-drawn maps containing not a little fresh information.

The Ancient Cities of the New World, being Travels and Explorations in Mexico and Central America, from 1857-1882. By DÉSIÉ CHARNAY. With numerous Illustrations. Translated from the French by J. Gonino and Helen S. Conant. London: Chapman and Hall, 1887. Pp. xxxii. and 514.

In point of typography and binding this is a very handsome book; and its numerous well-chosen and well-executed illustrations undoubtedly constitute one of its most valuable features. About the same time that the author, M. Charnay, was commissioned by the French Government to explore the monumental remains of the native civilisations of Mexico, an American gentleman, Mr. Lorillard, of New York, was on the point of fitting out a scientific expedition for the same purpose; but he not only generously abandoned his plan in favour of the French scholar, but lent him valuable pecuniary assistance. M. Charnay reached the scene of his labours early in the year 1880. More than twenty years before (1857), he had visited the same part of the world on a similar errand, so that he was not new to the work.

The author writes in an eminently lively and interesting style. But the plan of the book seems open to some adverse criticism. It consists of a narrative of travel, embroidered with the usual types of incidents, and intermingled with a scientific treatment of the ruined temples, palaces, and houses visited, and in several cases exhumed, by the traveller. The strictly scientific reader has therefore to wade through a great deal of purely adventitious matter, and, to

get a scientific whole, has to piece together the various patches interspersed with what are to him uninteresting details of travel. Nor can he get any such assistance as a well-prepared index would afford, since, as is so often the case with French books of this class, there is no index. It is strange that the translators, who in other respects seem to have acquitted themselves of their task well, have not supplied the deficiency.

Like most of those who have studied the antiquities, archæology, and ethnology connected with the defunct civilisations of Mexico and Central America, *M. Charnay* also has his theory. It is briefly this:—Those civilisations are of comparatively recent date, and all of Toltec origin. "The Mexican valley was occupied successively by various tribes, which, advancing from the north and north-west, entered the country towards the end of the seventh century. The first and most remarkable of these, both from the mildness of their character and the degree of their civilisation, were the Toltecs, who occupied Chapultepec as early as the eighth century, and established their capital at *Tula*, north of the Mexican valley, whose name *Toltec* was synonymous with architect. After a time, a rude tribe, the *Chichimecs*, entered the territory, and were soon followed by other races, amongst which were the *Aztecs* or *Mexicans*, and the *Acolhuans* or *Tezucans*. . . . The Toltecs, by the common consent of historians, were the most cultured of all the Nahua tribes, and better acquainted with the mode of perpetuating the traditions of their origin and antiquities. To them is due the invention of hieroglyphics. . . . The Toltecs were good architects, and skilled in mechanic arts; they built great cities like *Tula*, the ruins of which are still visible; whilst at *Totonac* they erected palaces of cut stone, ornamented with designs and human figures, recalling their chequered history." At the end of the eleventh century the Toltec Empire was broken up, and the various divisions of the nation spread themselves north and south, going down as far as Yucatan and Guatemala, along the coasts of both oceans. And it is to their agency that *M. Charnay* attributes the many extraordinary architectural remains at the various places he visited, and the positions of which he indicates, as well as the routes followed by the emigrants, on serviceable maps. We have no space to enter into the vast number of interesting details connected with that architecture, and the collateral subjects that arise out of it, such as religion, social and political usages, and the different arts of civilisation known to the people concerned; for these, and all other particulars of whatsoever kind, we must refer the curious as well as the interested reader to the book itself, assuring them that they will certainly find their attention captivated by its wealth of interesting matter.

Report on the Administration of the Punjab and its Dependencies for 1885-86.
Lahore, 1887.

In 1853 Parliament ordered the submission of an annual Administrative Report of each great province of India. The Reports produced were so badly prepared, that in 1862 Dr. George Smith, who for years compiled a summary of the whole, submitted to the late Earl of Elgin a uniform scientific system on which the Reports should be written. After three years of discussion in India and in the India Office, Sir Stafford Northcote, when Secretary of State in 1865, ordered the scheme to be adopted. Ever since, the twelve provinces of India, and some of the feudatory States, have reported according to this uniform statistical system. After every decennial census (or in 1882-83, on the last occasion) the physical and political geography of each province is specially

described, as well as the ethnological facts brought out by the enumeration of the people.

The present Report deals with the twenty-three millions of the most important province of India in a political and military sense, scattered over the same area as that of Austria-Hungary. The Afghan and Baloochistan frontier, and the native States ; the land survey and settlements ; the protective departments of legislature, police, prisons, justice, and the army ; the sources of production and distribution ; revenue and finance ; vital statistics and medical service ; public instruction ; literature and the press, are all passed in review for the official year ending March 1886. The folio volume begins with a general review of the whole by our Vice-President, Sir Charles U. Aitchison, K.C.S.I., the last he is likely to write, seeing that he laid down his office in April 1887, after a splendid five years' career, leaving the past year's administration to be summarised by his successor.

The great scientific value of these Administrative Reports, which Parliament ought to call for from the principal departments of the Administration of the United Kingdom and the Colonies, is in this case increased by a skeleton map of the Punjab and surrounding countries, brought down to the end of 1886. For the first time we see Baloochistan no longer separated from its suzerain of British India by a red line, like Afghanistan, while the new Central Asia railway is marked from Ruk on the Indus to the Sibi junction, whence one line runs up the Bolan Pass to Quetta, and another round by Chappar, both joining near Pisheen, and terminating for the present at Gulistan Karez, north of the Lora River. Thence to Kandahar, over the Khojak range and a desert plain, is only 70 miles, a distance which must one day be laid, and on to Herat, with the consent of the Afghans.

Sir Charles Aitchison, fortunately, has not severed his connection with India, although he has retired from the Bengal Civil Service. He hopes to return in October next as member of the Governor-General's Council, in charge of the Home Department.

The Society has also received from the Government of India, Reports on the Administration of Bombay Presidency, Madras Presidency, Hyderabad Assigned Districts, Coorg, and Bengal—all for the year 1885-86.

Précis de Géographie Élémentaire. Par PAUL CHAIX. Onzième Édition, revue et modifiée. Geneva : Cherbuliez. 1887.

We have great pleasure in calling attention to the text-book of Elementary Geography of M. Paul Chaix of Geneva. The fact that it has reached its eleventh edition may be taken as proof of the acceptance it has found in Switzerland and in France. That success will surprise no one who examines the book with any care. The object of the author has been to make geography an interesting study, and with that view he has avoided the common vice of multiplying names, and has preferred to occupy his space with the mention of things that are worth remembering, and that appeal to the intelligence of scholars. He has also been careful to observe the laws of perspective. In England and Wales, for example, the physical features named number less than a dozen, and only sixty towns are named ; but a full page is given to the description of London. In Scotland, mention is made of four mountains, five rivers, three lakes, and ten towns. The topography of France and Switzerland, on the other hand, is given with greater fulness. In countries near the reader, he is allowed to see details ; but in countries at a greater distance only the great and outstanding

features are brought into view. Another point worthy of note is the prominence given to physical aspect and physical conditions, which form the only sound basis of geographical teaching. The matter, besides being well selected, is also very conveniently arranged for educational purposes. Exception may be taken to some of the notes on pronunciation, but on the whole, the interpretations are successful. The work closes with chapters on mathematical, physical, commercial, and statistical Geography, which are on the whole very well done. We are glad to note that *M. Chaix* acknowledges himself, on his title-page, a member of the Scottish Geographical Society. It ought to be mentioned that, in preparing this edition of his book, *M. Paul Chaix* has had the assistance of *M. Émile Chaix*, who is a member of the Geographical Society of Geneva.

Longmans' New Geographical Readers: The Seventh Reader.—The Ocean, Currents, Tides, the Planetary System, and Phases of the Moon. London: Longmans, Green, and Co., 1887. Price 1s. 9d.

Of the many series of Geographical Readers in the market, there are very few that have ventured to grapple with the work of the Seventh Standard. The reason of that is obvious from the contents of this volume. The truth is that the work specified in the Code is not well adapted for being treated of in reading lessons, and the lessons are therefore apt to assume the form of chapters in a systematic treatise. There is not much scope for interesting or picturesque writing. Longman's Reader makes as much as possible of the available material. The scientific lessons on the ocean, ocean currents, and the separate oceans, on tides and winds, on the sun and the planets, are clearly written; and they are varied and relieved by interesting extracts from Lady Brassey, P. H. Gosse, and Hartwig, and by poetical pieces from Barry Cornwall, Byron, Coleridge, and other authors. The maps and diagrams are excellent; but the pictorial illustrations are, in many cases, old friends, not always with new faces; and many of them are crude specimens of the graver's and the printer's art.

NEW MAPS.

(Edited by Professor James Geikie, LL.D., F.R.S.)

EUROPE.

APENNINES. — Carta Topografica del Gran Sasso d'Italia pubblicata a cura della sezione di Roma del Club Alpino Italiano ed eseguita dal Socio G. E. FRITZSCHE.

A Topographical Map of the region of the Gran Sasso d'Italia ("Great Rock of Italy"), published by the Roman section of the Italian Alpine Club, in one sheet. It is reduced from the Italian Ordnance Survey Maps, 1:50,000, to the scale 1:80,000, with contour lines every 100 mètres, and embraces the whole group between the Vomano and Pescara valleys. It contains numerous alterations and additions of names, heights, etc., collected by the Alpine Club on their excursions through the group. The chromo-printing is in five colours: black for names, buildings, railways, and roads, blue for rivers, brown for mountains, green for meadows and forests, red for itineraries and other interesting indications. A small supplementary Map (1:25,000) of the principal summits of the

central group is inserted. This work has been very well executed in the Italian Cartographic Institute under the direction of Signor G. E. Fritzsche.

EUROPA, Temperaturkarten von —. Von ALEX. SUPAN. Massstab, 1:25,000,000.

- I. Dauer der Frostperiode.
- II. Dauer der Warmen Periode.
- III. Dauer der Heissen Periode.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 10. Gotha: Justus Perthes.

POCKET ATLAS OF ENGLAND, by JOHN BARTHOLOMEW, F.R.G.S., containing Maps and Plans, with Index and Statistical Notes.

London: John Walker & Co. Price 1s., cloth.

POCKET ATLAS OF SCOTLAND, by JOHN BARTHOLOMEW, F.R.G.S., containing Maps and Plans, with Index and Statistical Notes.

London: John Walker & Co. Price 1s., cloth.

The above little Atlases, which are very neatly got up, will be found useful and instructive travelling companions to tourists.

ASIA.

AFGHANISTAN AND N.-E. KHORASSAN, Geological Sketch Map of —, by C. L. GRIESBACH, C.I.E., *Geological Survey of India*. Scale, 1:3,000,000.

Records of the Geological Survey of India, Vol. xx., Part 2.

CEYLON, Völkervertheilungskarte der Insel.—Von P. u. F. SARASIN, 1887.

Verhandlungen der Gesell. für Erdkunde zu Berlin, Band xiv., No. 4.

Berlin: Dietrich Reimer.

JAPAN, Karte der Pflanzenzonen Japans, von JO TANAKA. Massstab, 1:7,500,000.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 9. Gotha: Justus Perthes.

SOUTH-EASTERN TIBET, and adjoining Countries, illustrating paper by General J. T. WALKER, R.E., C.B. Scale 1:5,500,000.

Proceedings of the Royal Geographical Society, June 1887.

ATLASES.

DIE ERDE in Karten und Bildern. Handatlas in 60 Karten, nebst 125 Bogen Text, mit 800 Illustrationen. In 50 Lieferungen vollständig.

Wien, Pest, Leipzig: A. Hartleben's Verlag. Price M. 1 (each Part).

This work, which promises to combine an excellent new Atlas with an interesting and richly illustrated description of the countries of the world, ought to form a most popular geographical compendium, especially for family use.

BERGHAUS' PHYSIKALISCHER ATLAS.—Zehnte Lieferung. Inhalt: Nr. 32, Isobaren im Jahre (Dr. J. HANN); Nr. 51, Nahrungs- und Genuss-Pflanzen (Dr. O. DRUDE); Nr. 72 Amerika zur Zeit der Entdeckungen (Dr. G. GERLAND).

Gotha: Justus Perthes, 1887. Preis M. 3.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

RECENT PHYSICAL RESEARCH IN THE NORTH SEA.

By HUGH ROBERT MILL, D.Sc., F.R.S.E., F.C.S.

THE North Sea or German Ocean has never been thoroughly investigated from the physical side. Up to last year information concerning the variations in it of temperature and salinity, from point to point and from season to season, was extremely meagre. The Hydrographic Department of the German Admiralty has recently published a small volume¹ containing the results of some short summer cruises, during which the gunboat *Drache*, under the command of Captain Holzhauer, was engaged in physical observations. The *Drache* had been employed in 1881 to make tidal observations on the Dogger Bank, and the following summer she was despatched to fill up some gaps left by the *Pomerania* Expedition of 1872 in the channels between Norway and Shetland, and between Shetland and Scotland. When the results were examined, the central area of the North Sea was found to be still unsurveyed, and in 1884 a cruise was made for the special study of that region. Stations were selected at intervals of 50 sea miles along certain lines; the ship was usually anchored while observations were made, and the position almost always determined astronomically.

Two instruments were at first employed for ascertaining temperature,—the slow-action thermometer, and Negretti and Zambra's revers-

¹ *Die Ergebnisse der Untersuchungsfahrten S.M. Kbnst "Drache," in der Nordsee in den Sommern 1881, 1882, und 1884.* Berlin, 1886.

ing thermometer. The latter thermometer was ultimately used alone. Experiments satisfied the observers that the probable error of each observation was less than $0\cdot5$ C.; about $0\cdot2$ or $0\cdot3$ as an average. The work of the Scottish Marine Station has shown that these thermometers may be used so as to give results with a probable error less than $0\cdot2$ F. for each reading, i.e. with $0\cdot1$ C. as the maximum limit of uncertainty. The manner of reversing the thermometer is not mentioned, but probably Magnaghi's frame was employed. The temperature results are given in tables, in curves showing the vertical distribution at each station, and in coloured sections across the sea in various directions. Observations were made in each case at the surface, and at 15, 30, 50, 100, 150, and 300 mètres when the depth admitted.

Specific gravity was determined on board by means of delicate hydrometers, the range from 1·00 to 1·03 being divided between ten instruments, so that readings correct to the fourth decimal place could be made. The results are reduced to their value at $17\cdot5$ C.; but the "absolute specific gravity" is also recorded. By this term is apparently meant the specific gravity of the water at the temperature it has in the sea. It is necessary in making comparisons between the results of different workers to bear in mind the extreme flexibility of the expression "specific gravity." Specific gravity is really the ratio of two densities; in the work under consideration it is the ratio of the density of sea water to that of pure water, and, since density depends on temperature, the ratio depends upon temperature doubly. In the records of the *Challenger*, "specific gravity" means the ratio of the density of sea water at 60° F. ($15\cdot56$ C.) to pure water at its maximum density point, 4° C.; since the latter density is universally taken as unity, the *Challenger* "specific gravity" of sea water is really the *density*, or mass of a given volume, at $15\cdot56$ C. In the work of the Meteorological Office, "specific gravity" means the ratio of the density of sea water at $15\cdot56$ C. to pure water at $15\cdot56$ C., and as the latter density is less than that at 4° , the number given for "specific gravity" by the Meteorological Office and most observers is for the same sample *greater* than that of the *Challenger* Reports. The "specific gravity" of Dr. John Gibson's "Report on the Water of the Moray Firth"¹ is the ratio of the density of sea water at 0° to that of pure water at 0° , and as this is directly determined there can be no possibility of error from reducing observations. For rigid scientific work performed in a laboratory the last-named method should alone be adopted. The *Drache's* "specific gravity" is that generally employed on the Continent, the ratio of the density of sea water at $17\cdot5$ C. to that of pure water at $17\cdot5$ C. To illustrate the necessity for care in defining the precise sense of this word of many meanings, we may give the figures which represent the "specific

¹ *Fourth Annual Report of the Fishery Board for Scotland, for 1885, Appendix, pp. 189-201.*

gravity" of the same sample of average sea water by each method alluded to; there are others in use also.

	I.	II.	III.	IV.
	1·02600	1·02695	1·02821	1·02683
I. <i>Challenger</i> method, ratio of density of sea water at 15'·56 to that of pure water at 4'				
II. Meteorological Office "	"	"	15·56	"
III. Dr. Gibson's "	"	"	0·0	"
IV. Continental "	"	"	17·5	"

In addition to the specific gravity, the *Drache* report contains a statement of the total salts, although it is not stated whether this quantity was directly determined or deduced from the hydrometer observations. Coloured charts of the North Sea give an extremely clear idea of the distribution of salinity and of "absolute specific gravity" on the surface, at a depth of 30 mètres and on the bottom. These form perhaps the most valuable part of the book; and although, on account of insufficient data, they must be taken with some reserve, they embody all that is known regarding the distribution of saline contents in the North Sea.

During the cruise of 1884, Dr. Neumeister, of the Kiel Commission, was on board, and took charge of the chemical work. Dredging was also carried on; but biologically the expeditions were of little interest. Professor Möbius, to whom the collections were made over, contented himself with recording the names of species obtained. The list only comprises 29 molluscs, 6 crustaceans, 4 worms, 11 echinoderms, 4 cœlenterates, and 2 sponges.

Configuration of the North Sea.—The beautifully printed bathymetrical chart of the Sea, which is appended to the *Drache* observations, brings out the singular form of the region with great distinctness. On the north, the division from the Norwegian Sea may be taken as a line drawn from the north of Shetland to Sogne Fjord, in latitude 61° N.; on the east, the coasts of Norway, Denmark, Germany, and Holland; on the south, Belgium and the 51st parallel; and on the west, the east coast of the British Islands form the boundaries. As a whole the sea is shallow, shoaling rapidly to the south and east; a range of banks runs north-east from Flamborough Head to the Skagerrack. From the British coast, deeper water—about 50 fathoms—extends north and east, deepening gradually until about 60 miles off the coast of Norway, where there is an abrupt change of slope, producing the great Norwegian gully of over 200 fathoms in depth, which encircles the southern end of the peninsula and passes along the northern shore of the Skagerrack. The conformation of the land is in intimate relation to that of the sea-bottom, being high to the north and along the western shore, but extremely low and flat to the east. The North Sea has three channels of communication with other waters; on the north it merges freely with the Nor-

wegian Sea and, through the channels of the Orkney and Shetland Islands, with the Atlantic Ocean ; on the east the brackish Baltic water finds entrance through the Cattegat and Skagerrack, and on the south there is the shallow Strait of Dover, forming a very restricted passage to the English Channel. The great rivers of Western Europe and of England enter the sea near its southern end, and give to it in large measure the character of a gigantic estuary, as the German observers prove, although they do not notice the fact. All these conditions conspire to make the physical phenomena of the North Sea irregular and difficult to investigate. The map, prepared by Mr. J. G. Bartholomew to illustrate this paper, shows all these features very clearly. It also brings out the relation of the North Sea to the eastern margin of the Atlantic Ocean, and to the land-masses of Great Britain and the Continent. The line of 100-fathom soundings off the west coast bounds the Continental plateau ; to the west of it the depth increases in a few miles to over 500 fathoms, and very rapidly to over 1000. To the east of the 100-fathom line there is gradual shoaling up to the coast, except in the neighbourhood of the shore of Norway.

Temperature of the North Sea.—In the great ocean a few observations of temperature give much information, for at depths exceeding some hundred fathoms seasonal fluctuations cease to manifest themselves, and in places far from shore, where the bottom is regular, the same distribution of temperature is found over thousands of square miles. In shallow seas things are quite different. The North Sea, for instance, is agitated by tides down to the bottom, enormous quantities of fresh and brackish water are poured in upon its surface ; and the changes of warmth between winter and summer exert a profound influence. Considering the bearings of temperature on animal life and of marine life on the fishing industry, one would imagine that of all seas that which washes our eastern coast would be the most thoroughly investigated. This is not the case, for except along the shores, where the water is extremely shallow and the conditions are consequently not representative, no observations have been taken in winter time, and few in summer. The *Drache* results for the summer months, May, June, July, are given for more than sixty stations spread over the whole area of the sea, and certain deductions are drawn from the consideration of them, although the data are meagre in the extreme for this purpose.

To give an idea of the state of matters during the cruise of 1882, the following table is extracted from the report. Stations A to H are fifty sea miles apart, between Helgoland and Aberdeen ; I to O between Aberdeen and Lerwick ; P to V from Lerwick to Mos Fjord ; W to GG from Kors Fjord to Helgoland. Temperature and depths are given in degrees Fahrenheit and fathoms, as well as in the Centigrade degrees and mètres of the original paper.

TABLE OF NORTH SEA TEMPERATURE IN 1882.—Continued.

STATIONS.		R		S		T		U		V		W		X		Y	
Position, { Lat. Long.		60° 30' N. 2° 30' E.		60° 31' N. 2° 51' E.		60° 32' N. 3° 11' E.		60° 32' N. 3° 30' E.		60° 34' N. 3° 51' E.		60° 6' N. 4° 52' E.		56° 31' N. 4° 48' E.		58° 42' N. 4° 32' E.	
Date and Hour, . . .		17th June, 10h. 0		17th June, 22h. 0		18th June, 1h. 0		18th June, 5h. 0		18th June, 9h. 0		30th June, 10h. 0		30th June, 21h. 0		1st July, 11h. 0	
Depths.																	
Met.		C°		F°		C°		F°		C°		C°		C°		C°	
0	0	10.1	50.2	10.9	51.6	10.1	50.2	10.7	51.3	10.1	50.2	14.8	58.6	14.6	58.2	14.2	57.6
15	8	10.0	50.0	10.7	51.2	10.0	50.0	10.1	50.2	10.0	50.0	14.2	57.6	13.4	56.1	12.7	54.8
30	16	8.3	46.9	9.4	48.9	10.0	50.0	8.6	47.5	9.2	48.6	12.8	55.0	11.6	52.9	10.1	50.2
50	244	7.8	46.0	8.2	46.7	9.8	49.6	8.1	46.6	8.1	46.6	8.2	46.8	9.0	48.2	7.9	46.2
100	483	7.5	45.5	7.9	46.2	9.1	48.4	8.0	46.4	8.1	46.6	6.8	44.2	6.6	43.9	7.4	45.3
150	73	...	...	...	...	8.0	46.4	8.1	46.6	8.2	46.8	7.3	45.1	7.0	44.6	7.0	44.6
200	97	...	...	...	...	8.0	46.4	8.1	46.6	8.5	47.3	8.3	46.9	7.0	44.6	6.9	44.4
300	146	...	...	...	...	...	...	7.7	45.9	7.1	44.8	7.0	44.6	7.0	44.6	6.8	44.2
Notes, . . .		* 97 met.		* 110 met.		* 38 met. † 204 met.		* 40 met. † 317 met.		* 40 met. † 302 met.				* 232 met.		* 260 met.	

STATIONS.		Z		AA		BB		CC		DD		EE		FF		GG	
Position, { Lat. Long.		58° 12' N. 4° 20' E.		58° 2' N. 4° 34' E.		57° 12' N. 4° 52' E.		56° 40' N. 5° 35' E.		55° 50' N. 5° 50' E.		55° 38' N. 5° 55' E.		54° 49' N. 6° 39' E.		54° 28' N. 7° 32' E.	
Date and Hour, . . .		1st July, 20h. 0		1st July, 22h. 0		2d July, 10h. 0		2d July, 19h. 0		2d July, 22h. 0		4th July, 16h. 0		5th July, 23h. 0		6th July, 9h. 0	
Depths.																	
Met.		C°		F°		C°		F°		C°		C°		C°		C°	
0	0	15.3	59.5	14.2	57.6	13.4	56.1	13.9	57.0	14.1	57.4	14.4	58.0	14.8	58.8	15.2	59.4
5	23	...	...	...	...	13.1	55.6	13.8	56.8	14.2	57.6	14.4	58.0	14.8	58.8	15.2	59.4
7.5	4	...	...	...	...	13.0	55.4	13.8	56.8	14.1	57.4	14.2	57.6	14.7	58.6	15.2	59.4
15	8	14.7	58.4	12.4	54.3	12.5	54.5	13.2	55.8	14.0	57.2	14.0	57.2	14.5	58.2	15.0	59.0
22.5	124	...	...	...	...	12.0	53.6	12.5	54.5	13.0	55.4	12.6	54.7	14.2	57.6	14.9	58.8
30	16	11.4	52.5	10.4	50.7	11.1	52.0	11.8	53.2	12.4	54.3	11.6	52.8	13.5	56.3		
50	244	8.2	46.8	7.5	45.5	9.0	48.2	8.3	47.0	...	...	...	...	...	...		
100	483	8.0	46.8	7.5	45.5	...	...	...	...	...	...	...	...	...	...		
150	73	7.6	45.7	7.5	45.5	...	...	...	...	...	...	...	...	...	...		
Notes, . . .		...		* 99 met.		...		* 52 met.		* 45 met.		* 40 met.		* 42 met.			

A rapid glance is sufficient to show that on the whole the temperature increased as the trip went on, and this being so, any reasoning from the observations must be of the most general nature possible. In fact, it is practically limited to a brief consideration of the four straight sections which were run over in a few days each, and these sections must be taken individually. The results apply only to the year of observation, as during the same period of another year quite different figures would be obtained; *e.g.*, at Horn's Reef Lightship, the following mean surface temperatures were observed in 1880 and 1881:—

Period.	1880.		1881.		Difference.	
	C.°	F.°	C.°	F.°	C.°	F.°
June 1-10, . . .	9·8	49·6	6·96	44·5	2·84	5·1
„ 11-20, . . .	10·7	51·2	6·75	44·2	3·95	7·0
„ 21-30, . . .	10·8	51·4	9·09	48·4	1·71	3·0
Monthly mean, . .	10·4	50·7	7·60	45·7	2·80	5·0

Also, in 1872, the *Pomerania* found a temperature of 5°·5 (41°·9 F.) at the bottom of the deep Norwegian Gut in 230 mètres (113 fathoms), while, at the same season, in 1882 the *Drache* found 7°·0 (44°·6), a difference of 2°·7 F. This difference may, however, be due, in part at least (although this is not suggested by the writer of the report) to the different thermometers used on the two cruises, since the *Drache's* instruments found a temperature of 6°·6 at 100 mètres, and might have found something lower if more frequent observations had been made, while the *Pomerania's* thermometers would probably have credited the lowest temperature in the vertical distance to the bottom.

The first section, from Helgoland to Aberdeen, between the 23d and 29th of May, shows surface temperature continually falling from 51°·8 to 48°·6, one anomalous sounding (B, 48°·2) on the north-eastward slope of the Dogger Bank excepted. At 8 fathoms, with the exception of B and H, the temperature did not change more than 0°·4 from 49°·5; but at 16 fathoms there is great variety, the temperatures ranging from 49°·8 to 44°·8. The lowest bottom temperature (44°·0) occurred in the deepest spot at station F, midway between the Dogger Bank and Aberdeen. On both sides of the bank the mass of water is below 47° on the bottom, but on the ridge itself it is 49°·3. Generally the result is to show warmer water on the German side and on the Dogger Bank than off the Scottish coast.

Six temperature soundings were made between Aberdeen and Lerwick during the 7th, 8th, and 9th of June. The temperature of the water throughout its mass increased steadily towards the north; this effect was most apparent on the bottom (about 50 fathoms), where

the warmth rose from $46^{\circ}0$ to $48^{\circ}0$ with perfect uniformity. It would appear that the warm water of the Atlantic flows eastward between the islands and makes its influence more clearly felt as the observer works northward from under the lee of Scotland.

June 16th, 17th, and 18th were occupied in running a section by means of seven soundings from Lerwick to the coast of Norway. The surface temperature, and that of the first 8 fathoms, was 50° , and on proceeding eastward the observers found colder water to approach the surface; the bottom temperature ($48\frac{1}{2}$ fathoms) up to the edge of the deep Norwegian trough fell from $46^{\circ}4$ to $45^{\circ}5$. On the other side of the edge, and descending into the great trough, the temperature at $48\frac{1}{2}$ fathoms was above $46^{\circ}5$, and as the depth increased the temperature fell very gradually, coming to $44^{\circ}8$ at the bottom in 147 fathoms. The vertical distribution of warmth here was very simple, being exactly similar to that of the same season in the Arran basin of the Clyde sea-area, viz., a rapid cooling for the first 20 fathoms, then an almost constant temperature to the bottom. The circle of observations was completed by eleven soundings, between June 30 and July 6, from Kors Fjord, down the deep trough (though not along its deepest part) across the Skagerrack, and along the Jutland coast to Helgoland. An extraordinary increase in the temperature of the upper layers is noticeable, the surface being at 56° to 59° , and water warmer than 50° extending down to 20 fathoms all along the section. In the deep part, $46^{\circ}5$ was reached at 25 fathoms, and $44^{\circ}6$ to $44^{\circ}2$ was registered at the bottom. On striking 28 fathom soundings, the bottom water was at $48^{\circ}2$, and by the time Helgoland was reached it had risen to $58^{\circ}8$. The vertical temperature curves in the deep channel were very interesting and irregular, showing the existence of superimposed layers of different temperature. It is matter of regret that when this phenomenon presented itself the observers did not break through their rule of observing only at 0, 8, 16, $24\frac{1}{2}$, $48\frac{1}{2}$, 73, 97, and 146 fathoms (0, 15, 30, 50, 100, 150, 200, 300 mètres); for a few additional readings at the points of inflection of the curve would have given to the results, value of a far higher order than they now possess. The direction of the observations was presumably in the hands of the officers of the ship, who fulfilled instructions, but were either powerless from the rigidity of routine, or indisposed through lack of interest in the problem they were engaged on, to take advantage of their opportunities. Physical observing is not merely a matter of marine surveying, but of scientific research; and as such it should be directed by a scientific head, capable of working up the results in a preliminary way on board, and seeing where the data should be supplemented or the methods modified. The German Admiralty deserve the thanks of all interested in marine research, and in the departments on which such work throws light, for what they have done; and it is with no wish to reflect adversely upon them that we express regret that they had not done more when they were doing much.

The discussion of the temperature results of the cruise described above, and of the cruise of 1884, with some additional observations, led the German authorities to certain conclusions which they very properly put forward with some diffidence, and which will certainly be considerably modified by future work. The most important is that the low temperature observed to the north of the Dogger Bank is due to the sinking of chilled surface-water, and not to the indraught of cold water from the Norwegian Deep. The evidence brought forward hardly seems to justify this statement, but it is useless to argue about such matters until there are more data to found upon.

Salinity of the North Sea.—The specific gravity, or to speak without ambiguity, the density, of sea water depends on three things—the amount of salts in solution, the temperature, and the pressure. In most discussions the last-named quantity is omitted, and attention confined to the two former. In the *Drache's* work the observations of density are much more valuable than those of temperature, in the sense that they are more permanent, and may be applied in framing hypotheses with some confidence.

The German record calls "specific gravity" the ratio of the density of the sea water at $17^{\circ}5\text{ C.}$ to that of pure water at the same temperature; "absolute specific gravity," the ratio of density of sea water at the actual temperature at which it occurs *in loco* to that of pure water at $17^{\circ}5\text{ C.}$ "Salinity" may be taken as the total amount of saline material dissolved in 100 parts of sea water, and this, in any discussion, may be considered as synonymous with specific gravity at constant temperature.

Three charts are given in which the salinity of the North Sea is represented by differences of colour, for three positions—the surface, a depth of 30 mètres (16 fathoms), and the bottom. The surface chart shows, to the north of Orkney, water with above 3.55 per cent. of salt, but this extends over a comparatively small area. Salinity of 3.50 per cent. has a much wider range. It extends from the Atlantic to within 80 nautical miles of the Norwegian coast, and the line bounding it on the chart follows the coast-line southward at that distance until off the north of Denmark, where it crosses over north of the Dogger Bank, to near Berwick, then at 40 miles off shore it swerves north-east, and curves south again towards Peterhead. The Moray Firth is left blank, but from observations that Dr. Gibson and I have made there, the 3.50 line was shown to extend right into that bight. Water of 3.50 salinity (the mean salinity for the ocean) thus occupies the centre of the North Sea north of the Dogger Bank, not approaching the eastern side, but lying close in to the Scottish coast, except between Berwick and Peterhead, where the freshened shore water drives it further to sea. A patch of water of equally high salinity was found by the *Pomerania* in the extreme south, between Yarmouth and Texel; this is probably connected with the surface current through the Strait of Dover. Salinity of 3.45 occurs all to the south of a line drawn at first

easterly across the south end of the Dogger Bank from Whitby, then north-easterly to the north of Denmark. The rest of the sea—the shallow area south of the Dogger Bank, the entrance to the Skagerrack, and a wide strip round the Norwegian coast—is of lower salinity, decreasing towards shore. The Continental side is very much fresher than the British.

On the chart for 30 mètres (16 fathoms) the lines denoting salinities of 3·55 and 3·50 run in the same direction as on the surface chart, only they include a greater area, the latter extending to the middle of the Dogger Bank, and running right up the Skagerrack. Along Norway the 3·50 line almost coincides with the 200 mètre (97 fms.) line of soundings. All the rest (except the salt streak from the channel) is fresher, freshening towards shore. The chart for 30 mètres is not correctly drawn, the 3·50 salinity line being incomplete, and the 3·45 line altogether omitted, although the necessary data are marked; the shades in this plate, and in the following one are different from those employed for distinguishing the same contours in the surface chart.

The salinity of bottom water is difficult to represent graphically for an area of such irregular depth as the North Sea. The bottom chart may be viewed as the projection on a horizontal plane of features, which would be more correctly traced on a surface inclined at a slight angle to the horizontal, in its southern half, and at a greater angle toward the northern extremity. This chart shows that on the bottom, water of 3·55 per cent. salinity comes in between Orkney and Shetland, and spreads out along the coast of Norway, close in shore; this salinity does not appear to extend to the Moray Firth. The 3·50 line shows the same curving away from the Scottish coast, as it did in other levels, and almost to the same amount, while the southern boundary of water of this degree of saltiness is the same as that at 30 mètres. The southern part of the sea has just the same salinity at the bottom as at 30 mètres—in fact, a great part of it does not exceed this depth.

These three plates embody most important observations, and it is not difficult to draw definite inferences from them. One thing is quite obvious, the salt water of the North Sea comes from the north, and the greater part of it at least from the Atlantic, and not the Norwegian Sea. Some salt water comes in through the Channel, but the amount is so small, and its influence so slight, that it may be neglected. Fresh water from the Rhine and other southern rivers, and the streams of Britain, plainly account for the low salinity of the southern half of the sea, and for that portion stretching to the north-east from a line joining Berwick to Peterhead; the latter area appears to be a prolongation of the Firths of Forth and Tay. The rivers of Germany, Denmark, and Norway, and the brackish water of the Baltic have a great effect in freshening the surface water and middle layers on the eastern side; but in the very deep water of the Norwegian Gut their influence is only superficial. It is remarkable that in the southern part of the deep, a salinity of 3·50 is reached at 50 mètres, while further north where the Baltic influence is

not felt, such a degree of saltness does not occur until 100, 200, or even 300 mètres is reached. This should be held as proof of the Atlantic origin of the salt water, since, if it came from the Norwegian Sea, the salinity would increase on going north. In the central and southern parts there is little difference between the salinity of surface and bottom.

In reasoning regarding the movements of water from observations on its physical properties, it is not with salinity, but with "absolute specific gravity" that we have to deal; and since this depends on the temperature, and the temperature varies in a manner not fully known, any application of isolated observations must be made guardedly. Three charts of absolute specific gravity are given in the same way as the three of salinity, but it will suffice for the present purpose to state the results arrived at by the German Hydrographic Office in considering these data.

Vertical distribution of absolute specific gravity is much more uniform than that of salinity or temperature, and its seasonal variation is intermediate between the two. In the Norwegian Deep there can be no vertical circulation, because the surface water is so much fresher than that beneath that no amount of cooling possible would make it dense enough to sink. In the middle of the North Sea, on the other hand, vertical circulation may very easily be set up in winter; and, although no observations have been made at that season, the *Drache* observers believed that the low temperature found on the north slope of the Dogger Bank in May was a sign not only that sinking *in loco* took place in winter, but that the effects of it persisted all summer in the shape of a permanently low bottom temperature. From my observations near shore, I should imagine that the latter was very unlikely, especially since the place of low temperature is not situated in a well-defined hollow. The maximum temperature, moreover, would not occur before August, and probably not before September, the minimum probably in February or even March; May, then, would present much more of the winter than of the summer conditions. That vertical circulation by winter-cooling and subsequent sinking takes place is probable; but in the shallow water of the Dogger Bank and its approaches, the influence of winds and tides will probably account better for the complete mixing of the water and the uniform distribution of density. The provisional conclusions of the hydrographer are confirmed, or at least not contradicted, by tidal observations, and may now be presented without further comment than his own remark, that they are only provisional in the absence of more certain data.

If the North Sea had only one opening to the north, through which dense salt water entered, while fresh water flowed from the other end, then, in the absence of disturbing conditions, the two kinds of water would tend to arrange themselves in horizontal layers. In doing so both currents would, under the influence of the earth's rotation, be deflected towards the west, while, if a circulation were set up, the return current would flow in an easterly curve. Notwithstanding the very numerous causes of disturbance, a circulation of this nature may be traced. The ocean water,

coming round the north of Scotland, shuts, as it were, the North Sea against the Polar current, and carries very salt Atlantic water extremely slowly, and almost unmixed, to the central part of the sea, where it cools and sinks in winter, and maintains its low temperature throughout summer on the slopes of the Dogger Bank and in the Norwegian Deep. The Atlantic water gets mixed, especially along the coast, with fresh water, and then flows north in two main currents—one along the British coast, and then north-east; the other along the German and Jutland shores, until it meets the brackish Baltic current. The two outflowing streams appear to unite between 3° E. long. and the coast of Norway, where they lose themselves in the Norwegian Sea. The two north-flowing currents are quite distinct in the North Sea: the British current consists of mixed water of pretty uniform salinity from surface to bottom; the Norwegian current is much fresher on the surface, and passes by a layer of mixed water into strong sea water below.

Dissolved Gases of Sea Water.—Professor Jacobsen describes the chemical work of the cruise. A large part of it was, however, done by Dr. Neumeister. The dissolved gases in sea water are subject to considerable variation; and from all observations which have been made, it appears that the quantity in solution is the amount of air which would be absorbed at the surface by sea water of the temperature it possesses in its place, *minus* the oxygen removed by processes of life or putrefaction, and *plus* the carbonic acid so produced. Twenty-five surface samples were examined, and in these the mean proportion of oxygen in the boiled-out gases was 33.95 per cent., the variations at different positions being very trifling. A greater quantity of oxygen was found dissolved in the surface water of the northern and central parts of the sea than further south and near the shore. In bottom water much greater fluctuations were found, as might be expected. The maximum quantity was 34.4, the minimum 25.2 per cent. More than 33.5 per cent. was found at the bottom all over the central part of the sea from the south end to near Shetland. In the extreme north, and around the coasts, an average amount of from 30.5 to 33.5 was found, and in a few places—viz., off Aberdeen, between Peterhead and Shetland, in the Norwegian fjords, and on the Jutland coast of the Skagerrack, less than 30 per cent. appeared. The chief cause producing a low proportion of dissolved oxygen seems to be prolonged stagnation of water over a bottom containing much oxidisable material. The carbonic acid of sea water has long been a subject of controversy; but in that aspect it is unnecessary to consider it here, and it will be sufficient to say that Dr. Jacobsen followed Törnøe's methods of alkalinity determinations to measure the amount of dissolved normal carbonates. The average of 67 observations gave 52.66 milligrammes per litre of carbonic acid combined as normal carbonate, and 43.7 milligrammes per litre as acid carbonate; but it is impossible to generalise from these observations without applying a correction for salinity. If the alkalinity

had been recorded in parts per hundred of dissolved salts, some interesting relations might be brought out; and, of course, when any use is to be made of the observations, the reduction to this ratio will be applied.

Nature of the Sea-bottom.—Professor Gümbel gives a careful mineralogical analysis of thirty-five samples of deposit from the bottom in different parts of the North Sea. As in the case of all land-locked seas, the deposits are composed, in the chief place, of the *débris* of land rocks, and of the mud and silt carried down by rivers. Organic remains are present also, sometimes in considerable amount, in the shape of shells and spicules of molluscs, echinoderms, foraminifera and diatoms; but no purely organic deposits occur. This part of the *Drache's* work has already been made the subject of authoritative criticism,¹ and it is therefore unnecessary to go into it here with greater detail.

Tidal Observations.—The tides of the North Sea are complicated, and although they have been studied for many years, they are not yet by any means fully understood. In general terms the phenomena may be thus described: The great Atlantic tide-wave, advancing from the west, divides at the Shetland Islands, one tide-wave enters the North Sea from the north-west, the other passes over to the Norwegian coast, where it is reflected, and moving south-westward from about Kors Fjord, meets the direct branch, and with it gives rise to a series of east and west cotidal lines of simultaneous high water. In latitude 54°, between Flamborough Head and Helgoland, the tidal current runs alternately eastward and westward, the period of high water at each end of the range being six hours apart. Sir William Thomson having proved that the tide through the Strait of Dover has no appreciable effect in the North Sea, the phenomena observed must be explained with reference to the northern tides alone. In spite of numerous disturbing causes, such as the irregular configuration of the bottom and the influence of wind, the observations which have been made are considered to agree sufficiently well with theory to make it probable that the tidal effects in the North Sea are produced by a combination of a stationary east-and-west wave with a progressive wave. The difficulty of satisfactory current observations is so great, that little reliance can be placed on the precise value of the velocities obtained for tidal streams.

The importance of a fuller knowledge of the phenomena of the North Sea hardly requires to be insisted on; but as no one individual and no one State is imperatively concerned with the investigation, it is likely that unless some bait in the way of "practical" results can be put forward, only spasmodic and partially satisfactory efforts will be made to clear up uncertainties. The great importance of a thorough comprehen-

¹ *Nature*, vol. xxxv. p. 73.

sion of tidal currents in navigation is perfectly obvious, and an illustration is given in the *Drache* Report of the possible value of salinity observations:—"Sounding in deep water is an operation so difficult, that in the case of sailing-ships it is often omitted to the danger of the vessel. For a ship passing through the Skagerrack, for instance, it would be no small advantage if by means of a simple hydrometer observation, the transition from water of 3·40 to 3·45 per cent. salinity could be ascertained. In summer, at least, the line of demarcation lies close to the 100-mètre line, and while to the north of this the ship is in deep water, to the south the lead must be kept going on account of the shoals lying off the Jutland coast." Much has been said and written of the bearing of temperature and salinity on fish movements. The relation must first be proved to exist or not to exist before anything can be done in the way of applying a knowledge of physical facts to fish-catching. At present all that can be said is that it is a promising field of inquiry.

What is most wanted in order to understand the course of seasonal changes in the water of the North Sea, is a series of observations repeated in as many places as possible—better in one place than in none at all—at regular intervals throughout the entire year; if practicable, for several years. If this cannot be done by scientific observers in a rigidly accurate manner, it is of value to have observations made by any honest worker, even at irregular intervals. Several of the smacks belonging to the very practical Mission to Deep-Sea Fishermen have been making observations on the fishing-grounds about the Dogger Bank during last winter, in connection with the National Fish Culture Association, and the results can hardly fail to be valuable.

Science is essentially cosmopolitan; still there are some departments in which national rivalry may be very appropriately called into play, and we should certainly like to see a vessel under the direction of the British Hydrographic Office beating the Germans on the North Sea in scientific investigations,—although we none the less heartily appreciate the work of the *Pomerania* and the *Drache*.

GEOGRAPHY AND GEOLOGY.¹

BY PROFESSOR JAMES GEIKIE, LL.D., F.R.S.

THE teaching of Geography naturally occupies a prominent place in every school curriculum. It is rightly considered essential that we should from an early age begin to know something of our own and other countries. I am not sure, however, that Geography is always taught in the most interesting and effective manner. Indeed, according to some geographers, who are well qualified to express an opinion, the manner in

¹ This paper forms a portion of a lecture given in 1886 to the Class of Geology in the University of Edinburgh.



THE ATLANTIC OCEAN: A PHYSICAL GEOGRAPHY AND

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which their subject is presented in many of our schools leaves much to be desired. But a decided advance has been made in recent years, and with the multiplication of excellent text-books, maps, and other appliances, I have no doubt that this improvement will continue. When I attended school the text-books used by my teachers were about as repellent as they could be. Our most important lesson was to commit to memory a multitude of place-names, and the maps which were supposed to illustrate the text-books were, if possible, less interesting and instructive. Nowadays, however, teachers have a number of more or less excellent manuals at their service, and the educational maps issued by our cartographers show in many cases a very great advance on the bald and misleading caricatures which did duty in my young days as pictures of the earth's surface.

During the progress of some war we often remark that the task of following the military operations compels us to brush up our Geography. I am uncharitable enough to suspect that it would frequently be truer to say that, before these campaigns commenced, we had no such knowledge to brush up. The countries involved in the commotion were probably mere names to many of us. We had no immediate interest in them or their inhabitants, and had we been asked, before the outbreak of hostilities, to indicate the precise positions of the places upon a map, some of us perhaps might have been sorely puzzled to do so. Nor is such ignorance always discreditable. One cannot know everything; the land-surface of the globe contains upwards of 52 millions of square miles, and one may surely be excused for not having a detailed knowledge of this vast area. I have referred to the subject simply because I think it gives us a hint as to how the teaching of Political Geography might be made most instructive and interesting. Historical narrative might often be interwoven with the subject in such a way as to fix geographical features indelibly on the memory. Striking and picturesque incidents, eventful wars, the rise and progress of particular trades, the routes followed by commerce, the immigration and emigration of races, the gradual development of the existing political divisions of the Old World, the story of Columbus and the early voyagers, the geographical discoveries of later times—all these, and such as these, might be introduced into our lessons in Political Geography. The wanderings of a Mungo Park, a Bruce, a Livingstone, a Stanley, traced on a good map, could not fail to arrest the attention of the youthful student of African geography. In like manner the campaigns of the great Napoleon might be made to do good service in illustrating the geographical features of large portions of our own continent. Then, as regards Britain, what a world of poetry and romantic story clings to every portion of its surface—why, the very place-names themselves might suggest to any intelligent teacher themes and incidents, the deft treatment of which would make the acquisition of Geography a delightful task to the dullest boy or girl.

The intimate relation that obtains between Political Geography and

History has indeed long been recognised, and is in fact self-evident. And we are all well aware that in our school manuals of Geography it has been usual for very many years to note the scenes of remarkable events. Such notes, however, are of necessity extremely brief; and it need hardly be said that to fully incorporate history in a text-book of general Geography would be quite impracticable. It might be done to a certain extent for our own and a few of the more important countries; but similar detail need not be attempted in regard to regions which are of less consequence from the political point of view. Indeed, I should be inclined to leave the proper application of historical knowledge in the teaching of Geography very much to the teacher himself, who would naturally select such themes and incidents as seemed best adapted to attract the attention of his pupils. Be that, however, as it may, it is enough for my present purpose if I insist upon the fact that the proper study of Political Geography involves the acquisition of some historical knowledge. One can hardly conceive the possibility of an intelligent student taking pains to become acquainted with the political geography of a country without at the same time endeavouring to learn something of its history—otherwise, his geographical attainments would hardly surpass those of a commercial traveller, whose geographical studies have been confined to the maps and tables of his Bradshaw.

But if it be impossible to ignore History in the teaching of Political Geography, it is just as impossible to exclude from our attention great physical features and characteristics. Surface-configuration, climate, and natural products all claim our attention. It is obvious in fact that the proper study of Political Geography must give us at least a general notion of the configuration, the river-systems, and climatic conditions of many different lands. For has not the political development of races depended most largely on the physical conditions and natural resources of the countries occupied by them? So far then as these have sensibly influenced the progress of peoples, they come naturally under the consideration of Political Geography. Thus, if Political Geography be closely connected and interwoven, as it were, with History, not less intimate are its relations to Physical Geography. It does not embrace all Physical Geography, but it introduces us to many facts and phenomena the causes and mutual relations of which we cannot understand without first mastering the teachings of Physical Geography. In the study of this latter science we come more closely into contact with Nature; we cease to think of the surface of the earth as parcelled out into so many lots by its human occupants—we no longer contemplate that surface from the limited point of view of the political geographer—we are now not merely members of one particular community, but have become true citizens of the world. To us north and south, east and west are of equal interest and importance. Our desire now is to understand, if haply we may, the complex system of which we ourselves form a part. The distribution of land and water—the configuration of continental areas and oceanic basins—the circulation of oceanic

and terrestrial waters—earth-movements and volcanoes—ice-formations—the atmosphere—climatology—the geographical distribution of plants and animals—in a word, *the world as one organic whole* now forms the subject of our contemplation. Such being the scope of Physical Geography, it is satisfactory to know that its importance as a subject of study in our schools has been fully recognised. This being admitted, I shall now proceed to show that Physical Geography, although, like Political Geography, it is a separate and distinct subject, yet, just as the study of the latter involves some knowledge of History, so the prosecution of Physical Geography compels us to make a certain acquaintance with Geology. We cannot, in fact, learn much about the atmosphere, about rain and rivers, glaciers and icebergs, earthquakes and volcanoes, and the causes of climate, without at the same time becoming more or less familiar with the groundwork on which geological investigations are based. And just as a knowledge of history enables us better to understand the facts of Political Geography, so some acquaintance with the results of geological inquiry are necessary before we can hope to comprehend many of the phenomena of which Physical Geography treats. Let me try to make this plain. The physical geographer, we shall suppose, is considering the subject of terrestrial waters. He tells us what is meant by the drainage-system of a country, points out how the various minor water-courses or brooks and streams unite to form a river, describes for us the shape of the valley through which a typical river makes its way—how the valley-slope diminishes from the mountains onwards to the sea-coast—how, at first, in its upper or mountain-track, the flow of the river is torrential—how, as the slope of the valley decreases, the river begins to wind about more freely, until it reaches the head of its plain-track or delta, when, no longer receiving affluents, it begins to divide, and enters the sea at last by many mouths. He tells us further what proportion of the rainfall of the country passes seawards in our river, and he can measure for us the quantity of water which is actually discharged. All this is purely Physical Geography; but when we come to ask why some rivers flow in deep cañons like those of the Colorado—why valleys should widen out in one part and contract, as it were, elsewhere—why the courses of some rivers are interrupted by waterfalls and rapids, and many other similar questions, the physical geographer must know something of Geology before he can give an answer. He can describe the actual existing conditions; without the aid of Geology, he can tell us nothing of their origin and cause. So the political geographer can map out for us the present limits of the various countries of Europe, but history must be invoked if we would know how those boundaries came to be determined. The moment, therefore, the physical geographer begins to inquire into the origin of any particular physical feature, he enters upon the domains of the geologist. And as he cannot possibly avoid doing so, it is quite common now to find a good deal of the subject-matter of Geology treated of in text-books of Physical Geography. I state this merely to show how very closely the two sciences

are interlocked. Take, for example, the configuration of river valleys just referred to. The physical geographer recognises the fact that a river performs work : by means of the sediment which it carries in suspension and rolls along its course, it erodes its bed in many places, and undermines its banks, and thus its channel is deepened and widened. He can measure the amount of sediment which it carries down to the sea, and the quantity of saline matters which its waters hold in solution : and knowing that all these substances have been abstracted from the land, he is able to estimate approximately the amount of material which is annually transferred from the surface of the drainage-area involved. He finds that this is so relatively enormous that he has no difficulty in believing that the valleys in which rivers flow might have been hollowed out by the rivers themselves. But without trespassing further into the geologist's domains, he cannot go beyond this : and you will at once perceive that something more is required to prove that any particular valley owes its origin to the erosive action of running water. Suppose some one were to suggest to him that his river-valley might be a minor wrinkle in the earth's crust caused by earth-movements, or that it might indicate the line of a fissure or dislocation, due to some comparatively recent convulsion—how could his computation of the amount of material at present carried seawards by the river prove such suggestions to be erroneous? And what light could it throw upon the origin of the varied configuration of the river-valley—how would it explain the presence or absence of cascades and rapids, of narrow gorges and open expanses? None of these phenomena can be interpreted and accounted for without the aid of the geologist : without some knowledge of rocks and rock-structures, the origin of the earth's surface-features is quite inexplicable. To give an adequate explanation of all the surface-features of a country in detail would of course require a profound study of Geology, but a general acquaintance only with its elementary facts is quite sufficient to enable us to form a reasonable and intelligent view of the cause and origin of the main features of the land as a whole. Thus a few lessons in elementary Geology would make clear to any child how rivers have excavated valleys, why cataracts and gorges occur here, and open valleys with gently-flowing waters elsewhere.

Let me select yet another example to show how dependent Physical Geography is upon Geology. The physical geographer, in describing the features of the land, tells us how the great continental areas are traversed in various directions by what he calls mountain-chains. Thus, in speaking of America, he tells us that it may be taken as a type of the continental structure—namely, a vast expanse of land, low or basin-like in the interior, and flanked along the maritime regions by elevated mountain borders—the highest border facing the deepest ocean. He points out further that the great continental areas are crossed from west to east by well-marked depressions, to a large extent occupied by water. Thus Europe is separated from Africa by the Mediterranean, a depression which is continued eastward through the Black Sea into the Aralo-Caspian area.

South America is all but cut away from North America, while Australia is separated from Asia by the East India Seas. We find in fact all over the world that well-marked natural features are constantly being repeated. Not only do the great land-masses of the globe bear certain resemblances to each other, but even in their detailed structure similar parallelisms recur. The physical geographer notes all these remarkable phenomena, but he can give us no clue to their meaning. He may describe with admirable skill the characteristic features of plains and plateaux, of volcanic mountains and mountain-chains, but he cannot tell us why plains should occur here and mountains there; nor can he explain why some mountains, such as those of Scotland or Norway, differ so much in configuration from the Alps and the Pyrenees. The answer to all these questions can only be given by Geology. It is from this science we learn how continental areas and oceanic basins have been evolved. The patient study of the rocks has revealed the origin of the present configuration of the land. There is not a hill or valley, not a plateau or mountain-region, which does not reveal its own history. The geologist can tell you why continents are bordered by coast-ranges, and why their interiors are generally comparatively low and basin-shaped. The oceanic basins and continental areas, we learn, are primeval wrinkles in the earth's crust, caused by the sinking down of that crust upon the gradually cooling and contracting nucleus. The continents are immense plateau-like areas rising more or less abruptly above those stupendous depressions of the earth's crust which are occupied by the ocean. While those depressions are in progress the maritime borders of the land-areas are subjected to enormous squeezing and crushing, and coast-ranges are the result—the elevation of those ranges necessarily holding some relation to the depth of the contiguous ocean. For, the deeper the ocean the greater has been the depression under the sea, and consequently the more intense the upheaval along the continental borders. It is for the same reason that destructive earthquakes are most likely to occur in the vicinity of coast-ranges which are of comparatively recent geological age. These, and indeed all, mountains of elevation are lines of weakness, along which earth-movements may continue from time to time to take place. But all mountains are not mountains of elevation; many elevated regions owe their mountainous character simply to the erosive action of subaërial agents, such as rain, frost, ice, and running water, the forms assumed by the mountains being due to their petrological character and geological structure. There are, for example, no true mountains of elevation in Scotland; hence to write of the *chain of the Grampians* or the *range of the Lowthers* is incorrect and actually misleading. Without the aid of Geology the geographer cannot in fact discriminate between mountains of elevation and mountains of denudation; hence geographical terms so constantly in use as *mountain-range* and *mountain-chain* are very often applied by writers, ignorant of geological structure, to elevated regions which have no claim to be described either as *chains* or *ranges*. Some knowledge of Geology, therefore,

is essential to us if we would have correct views of many of the grandest features of the globe. But it will be said that, after all, the physical geographer deals with the earth as we now find it; he does not need to trouble himself with the origin of the phenomena he describes. Well, as I have just shown, he cannot, even if he would, escape trenching on Geology; and if he could, his subject would be shorn of much of its interest. He recognises that the world he studies has in it the elements of change—the forces of Nature are everywhere modifying the earth's surface—considerable changes are sometimes brought about even in one's lifetime, while within the course of historical ages still greater mutations have taken place,—he becomes conscious, in short, that the existing state of things is but the latest phase of an interminable series of changes stretching back into the illimitable past, and destined to be prolonged forward into the indefinite future. Thus he gladly welcomes the labours of the geologist, whose researches into the past have thrown such a flood of light upon the present. In fact, he can no more divorce his attention from the results of geological inquiry than can the political geographer shut his eyes to the facts of History.

Let me, in conclusion, give one further illustration of the close interdependence of the two sciences of which I am speaking. One of the subjects treated of by Physical Geography is the present geographical distribution of plants and animals. The land-surface of the globe has been mapped out into so many biological regions, each of which is characterised by its special fauna and flora. The greatest changes in the flora and fauna of a continent are met with as we pass from south to north, or *vice versa*. Proceeding in the direction of the latitude, the changes encountered are much less striking. Now these facts are readily explained by the physical geographer, who points out that the distribution is due chiefly to climatic conditions—a conclusion which is obvious enough. But when we go into details we find that mere latitude will not account for all the phenomena. Take, for example, the case of the Scandinavian flora of our own Continent. It is true that this flora is largely confined to the northern latitudes; but isolated colonies occur in our own mountains and in the mountains of middle and southern Europe. How are these to be accounted for? The physical geographer says that the plants grow there simply because they obtain at high levels in low latitudes the favourable climatic conditions underneath which they flourish at low levels in high latitudes. He therefore concludes that the distribution of life-forms is due to varying climatic and physical conditions. But if we ask him how those curious colonies of foreigners come to be planted on our mountains, he cannot tell us. To get our answer we must come to the geologist; and he will tell us that they are, as it were, living fossils—monuments of former great physical and climatic changes. He will prove to us that the climate of Europe was at a recent geological period so cold that the Scandinavian flora spread south into middle Europe, where it occupied the low grounds. When the climate became milder, then the northern

invaders gradually retired—the main body migrating back to the north—while some stragglers retreated before the stronger Germanic flora and took shelter in the mountains, whither the latter could not or would not follow, and so there our Scandinavians remain, the silent witnesses of a stupendous climatic revolution. Now, all the world over, plants and animals have similar wonderful tales to tell of former geographical changes. The flora and fauna of our country, for example, prove that the British Islands formed part of the Continent at a very recent geological period; and so, from similar evidence we know that not long ago Europe was joined on to Africa. On the other hand, the facts connected with the present distribution of life demonstrate that some areas, such as Australia, have been separated from the nearest continental land for vastly prolonged periods of time.

It would be a very easy matter to adduce many further illustrations to show how close is the connection between the studies of the physical geographer and the geologist. I do not indeed exaggerate when I say that no one can hope to become a geologist who is not well versed in Physical Geography; nor, on the other hand, can the physical geographer possibly dispense with the aid of Geology. The two subjects are as closely related and interwoven, the one with the other, as is History with Political Geography. I do not see therefore how educationists who have admitted the great importance of Physical Geography as a branch of general education, can logically exclude Geology as a subject of instruction in schools. Already, indeed, it has been introduced by many teachers, and I am confident that ere long it will be as generally taught as Physical Geography is now. I would not, however, present the subject to young people as a lesson to be learned from books. A good teacher should be able to dispense with these helps, or rather hindrances—for such they really are to a young beginner. His pupils ought to have previously studied the subject of Physical Geography, and if they have been well taught they ought to have already acquired no mean store of geological knowledge. They ought, in fact, to have learned a good deal about the great forces which are continually modifying the surface of the globe, and what they have now to do is to study more particularly the results which have followed from the constant working of those natural forces. We shall suppose, for example, that the teacher has described how rivers erode their channels, and waves tend to cut back a coast-line, and how the products of erosion, consisting of gravel, sand, and mud, are distributed along river-valleys, and accumulated in lakes and seas. He now exhibits to his class good-sized fragments of conglomerate, sandstone, and shale, and points out how each of these rocks is of essentially the same character, and must therefore have had the same origin as modern sedimentary accumulations. His pupils should be encouraged to examine the rocks of their own neighbourhood, whether exhibited in natural sections or artificial exposures, and to compare these with the products of modern geological action. One hour's instruction in the field is, in fact, worth twenty hours'

of reading or listening to lectures. One may put into the hands of a youth a clear and well-written description of some particular fossiliferous limestone, and he may by dint of slavish toil be able to repeat verbatim all that he has read. That is how a good deal of book-knowledge of science is acquired. Only think, however, of the drudgery it involves—the absolute waste of time and energy. But let us illustrate our lesson by means of a lump of the limestone itself; let us show him the character of the rock and the nature of its fossil contents, and his difficulties disappear. Better still—let us take him, if we can, into a limestone quarry, and he will be a dull boy indeed if he fails fully to understand what limestone is, or to realise the fact that the rock he is looking at accumulated slowly, like existing oceanic formations, at the bottom of a sea that teemed with animal life. It is unnecessary, however, that I should illustrate this subject further. I would only repeat that the beginner should be taught from the very first to use his own eyes, and to draw logical conclusions from the facts which he observes. Trained after this manner, he would acquire not only a precise and definite knowledge of what geological data really are, but he would learn also how to interpret those data. He would become familiar, in fact, with the guiding principles of geological inquiry.

How much or how little of Historical Geology should be given in schools will depend upon circumstances. Great care, however, should be taken to avoid wearying the youthful student with strings of mere names. What good is gained by learning to repeat the names of fifty or a hundred fossils, if you cannot recognise any one of these when it is put into your hand? With young beginners I should not attempt anything of that kind. If the neighbourhood chanced to be rich in fossils, I should take my pupils out on Saturday to the sections where they were found, and let them ply their hammers and collect specimens for themselves. I should describe no fossils which they had not seen and handled. Of the more remarkable forms of extinct animals and plants, which are often represented by only fragmentary remains, I should exhibit drawings showing the creatures as they have been restored by the labours of comparative anatomists. Such restorations and ideal views of geological scenes like those given by Heer, Dana, Saporta, and others, convey far more vivid impressions of the life of a geological period than the most elaborate description. In fine, the story of our earth should be told much in the same manner as Scott wrote the history of Scotland for his grandson. There is no more reason for requiring the juvenile student to drudge through minute geological data before introducing him to the grand results of geological investigation, than there is for compelling him to study the manuscripts in our Record Offices before allowing him to read the history which has been drawn from these and similar sources of information. It is enough if at the beginning of his studies he has already learned the general nature of geological evidence and the method of its interpretation. Provided with such a stock of geological knowledge

as I have indicated, our youth would leave school with some intelligent appreciation of existing physical conditions, and a not inadequate conception of world-history.

THE MONBUTTU AND THEIR COUNTRY.

BY EMIN PASHA AND CAPTAIN CASATI.

THE *Società d'Esplorazione Commerciale in Africa* have issued a supplement to their May *Bullettino*, containing (I.) a communication from Emin Pasha on the Monbuttu people, accompanied by a short letter, dated from Wadelai on 6th May 1886; and (II.) a series of nine letters from the Italian Captain Casati, dating from 19th July to 5th September 1883, and from 1st August 1885 to 28th October 1886.

I. The Monbuttu, owing to their physical qualities and intellectual vigour, occupy a leading position among the peoples of Nigritia. According to the tradition current amongst them, their ancestors came from the north-west, having crossed on their way a very extensive sheet of water. On reaching the basin of the river Kibali (Makua-Wellé) they subjugated the indigenous populations they found there, such as the Momvù, the Abarambo, and others, who, though they have been partly assimilated by their conquerors, still live partly to themselves as a race standing at an inferior social level. The Monbuttu consist of several tribes, the principal being the Bamba and the Majanga, who settled in the Macraca country, and in the region watered by the Bahr-el-Gazal. The Momvù, who are somewhat smaller and darker in hue than the Monbuttu, represent the *gens* or *populus* of the country, and are industrious agriculturists. Both to the east and to the west of Wadelai they possess wide stretches of prosperous cultivated land. The principal chiefs and rulers occupy their positions by right of hereditary descent; but if at the death of a chief he has no son old enough to undertake the responsibility, the brother or other near male relative of the deceased acts as regent for the time being. The minor chiefs were at first nominated by their superiors, who still retain the right, although in practice the hereditary principle prevails for the most part. The chiefs exact no regular imposts; but from time to time the inferior chiefs are compelled to present themselves before their superiors, and on such occasions they bring contributions of slave boys, cattle, iron, leather, etc. The usual *menu* of a Monbuttu meal is selected from the following list:—Bananas, yams, manioc, sesame, a little eleusine, sorghum, *Penicillaria*, various species of *Cucurbitaceæ*, *Colocasieæ*, and immense quantities of fruit; the flesh of the animals slain in the chase, that of monkeys, lions, elephants, snakes, poultry, hens' eggs, many species of birds, insects, larvæ, and human flesh. *Articles de luxe* are tobacco, beer (hydromel), and cola-nuts. Con-

trary to the practice of peoples amongst whom there exist strict class distinctions, Monbuttu of superior caste often take a spouse from an inferior caste. Marriages are brought about by the mediation of a third person, presents (slaves, cattle, iron) being given either to the father of the girl or divided between the match-maker and the nearest relatives of the young couple. On the death of a Monbuttu all his substance passes to his eldest son. The dead are generally buried. But one tribe, the Maggio (Madsò), who keep themselves separate from the rest, practise cremation. As a sign of grief the mourners shave their heads and abstain from ablutions and the transaction of business. On the whole, the women enjoy a better social position than the majority of their Negro sisters. After the day's work is done, singing and dancing begin. The men and the women have their respective dances, which they perform on certain special occasions. Both men and women cut off a piece of the external membrane of the ear; another practice is to file the two upper incisors to a point. Circumcision is practised by this people, the occasion being celebrated by the rich by festivities lasting from eight to fourteen days. The children of the ruling chiefs at a tender age have their heads forcibly pressed into an elongated shape by means of ligatures. The Monbuttu make excellent utensils and articles of furniture, both of wood and of clay.

II. Captain Casati's first letter treats of the Mege, a people subdued by the Monbuttu, whose language and customs they have adopted. What at once strikes the European is a curious air of savagery, mixed with ferocity and mistrust, which distinguishes them. As a rule, they are of a dark brown colour, have rather coarse features, nostrils much dilated, stalwart limbs, and are expert hunters of elephants and other wild animals, handling their only weapon, the bow, with great skill. It is only the superior chiefs and principal men who carry in addition lances and shields. The territory they occupy differs but little from that inhabited by the other Monbuttu tribes. Four days' journey south-west of the former residence of Sultan Azanga lies Mount Ambambula, of no great height, and only remarkable from the fact that the plateaux which surround it contain the origins of numerous rivers—on the west, the Teli and Poko, whose united waters flow into the Bomokandi or Nomaio; on the south, the Blima, which joins the Nava; on the south-east, the Nava, which flows west to the Wellé; and on the north, the Rungu and Nosso, affluents of the Nomaio.

The second letter gives some particulars of that portion of the route between Tangasi and Lado which belongs to the basin of the Makua-Wellé. In this limited district the principal stream is the Kibali,—the Makua of the A-Sandeh and the Obi of the Loggo. This river ought also, properly speaking, to be regarded as the head-stream of the Wellé, since the Gadda, which, along with the Kibali, is commonly held to constitute it, is of secondary importance when compared with the Kibali. Whereas

the mean breadth of this last, which comes from the south-east with a current of moderate velocity, is 80 yards, the width of the Gadda is but one-fourth of that. The second important river of the basin is the Dongu (called Io by the Loggo); it comes from the east, and has a rapid current flowing in a stony bed. Its breadth at the station of Dongu is about 44 yards. Another river—the Ello—which rises near Tangasi, is nearly 40 yards wide not far from its source. The Arabs state that it is an affluent of the Gadda, but it would be more consonant with fact to regard the Gadda as an affluent of the Ello. The principal tributaries of the Dongu are the Borser and the Ottua, which come from the east, and join the main stream not far from the station of Mondu; and the Akka, which in turn receives the Garamba, both having a westerly direction. The altitude of a few points will give some idea of the surface configuration of the country. From Tangasi, at 2300 feet, the surface rises to 2510 at Kubi, and falls away again to 2200 at the Kibali. Eastwards from this river it has a continuous and steady ascent, having an altitude of 2330 feet at Dongu (station), 2460 feet at Mundu, 2625 at Lerio, and 2660 at Tandia. The route from Tangasi to Lado, owing to the numerous streams and the marshes they form—and this holds especially of the tributaries of the Dongu—is extremely unhealthy.

The third letter relates to certain measures taken by Emin Pasha to keep open the routes of communication in the south-western parts of the Equatorial Province. The fourth letter contains certain suggestions by Captain Casati for the final stamping out of the slave-trade, and proposals for the consolidation of the Egyptian power in the Equatorial regions of Africa, mainly of the nature of administrative changes.

Then comes, in the fifth letter, some purely geographical matter, viz., notes to accompany Casati's map of the eastern part of the Makua and its affluents. The mountain chain which stretches south and south-west from Lake Albert, and sends off ramifications northwards into the country of the Macraca and Abaca, probably constitutes the line of water-parting between the basins of the Nile and the Congo. In this chain the Wellé has its origin, and flows thence towards the north-north-west, skirting the country of the Calica; then, assuming the name of Kibali, it goes west-north-west to a point beyond 28° E. long., where its volume is augmented by the rivers Jubbo, Dongu, Calpili, and Ello-Gadda; after that it is known as the Wellé. The Makua has an imposing volume of water, especially in the season of heavy rains; it runs in a broad bed between high banks, forms several little islands, and has a medium velocity. In some places there are whirlpools. Its waters are inhabited by large herds of crocodiles. The writer then proceeds to repeat, with respect to the other rivers of the region, pretty much the same particulars as those given in the second letter.

The next two letters are full of political news, relating to the contest maintained by Emin Pasha and his gallant followers with the troops of the Mahdi's lieutenant, Sheikh Keremallah Mohammed; and the eighth

letter, after continuing the same subject, passes on to describe the relations which existed between King Kabrega of Unyoro and the rulers of the Equatorial Province. The last letter deals mainly with personal matters, chiefly having reference to Dr. Junker's departure from Central Africa and his expected arrival in Italy.

The supplement concludes with what are undoubtedly a valuable series of meteorological observations, taken by Captain Casati, mostly at the station of Gadda (2430 feet), during the first seven months of 1884. The instruments used were two good thermometers by Kappeller, of Vienna, and a small aneroid. The observations taken embraced the readings of the thermometers (wet and dry) and of the aneroid, the direction and force of the wind, the state of the atmosphere, and the occurrence and duration of rain, of thunder, and of lightning. In all cases the hour at which the observations were made is carefully noted. The hours selected were 7 A.M., 2 P.M., and 9 P.M.

The following table gives certain salient facts and results, which are recorded in the tabulated observations :—

Month of 1884.	Thermometric Readings.		Aneroid Readings.		Direction of Prevalent Winds.	Number of Rainy Days.
	Max.	Min.	Max.	Min.		
January, . .	36°	8°-80	699	684	North and north-east.	2
February, . .	38°-80	9°	699	684	North and north-west.	2
March, . . .	38°-20	16°-60	697	682	North-west and north-east.	11
April, . . .	36°-80	17°-20	699	684	North, north-east, and north-west.	15
May, ...	37°-40	17°-80	700	685	North-east and south-east.	15
June, ¹	33°-60	17°-40	700	680	North-east.	5
July, ²	34°-40	17°-60	700	686	North, north-west, and north-east.	8

J. T. B.

UPPER BURMA DURING 1886.

THE first complete Annual Report of a newly acquired province cannot fail to have interest for those who have watched the progress of our army and administrators peacefully from home. The acquisition of Upper Burma has cost Great Britain much blood and treasure, by many

¹ No observations are recorded for the 9th to 12th, the 15th to the 17th, and the 21st to the 24th inclusive. The observations of the 13th, 14th, and 18th-20th were taken at Bellima, 2428 feet above sea-level; and those of the 25th-30th at Gadda, 2430 feet.

² No observations are recorded after the 17th of the month.

thought to be unnecessary; but the time is past for considering the desirableness of the annexation—how the country is to be governed is the problem to be faced.

The history of the administration of the year 1886 is before us in the Government official report,¹ courteously forwarded by the India Office.

Geographical Position.—The geographical position of the new province is thus described:—"The territory of Upper Burma, including the Shan States, covers nearly 200,000 square miles, of which area, approximately, one-half pertains to the Shan States and one-half constitutes Upper Burma proper. On the south, Upper Burma is bounded by the British province of Lower Burma. On the west and north-west the maps show Upper Burma to be bounded by the British provinces of Arakan, Chittagong, Assam, and the feudatory State of Manipur. But, as a matter of fact, there lie between Burma and India in this direction semi-civilised tribes, such as Chins, Lushais, Singphos, and others, who have never come really under the control either of the British or of the late Burmese Government. To the north and north-east Upper Burma is bounded by China and tribes subordinate to China. Concerning the people on the northernmost border at present hardly anything is known. But between Upper Burma and Chinese territory proper, on the north-east, extends a belt of country inhabited by predatory clans of Kachins, who may be geographically within the Empire of China, but who in reality pay no allegiance to anybody. Along the eastern border of Upper Burma proper, from Bhamo to Toungoo, lie the Shan States, which used to be dependencies of the Ava dynasty, but which in the late King's time had more or less thrown off Burman domination."

The late Dynasty.—The dynasty that terminated in the deposition of Theebaw was originally founded by Alaungpaya in 1752, who, with a career similar to Sivagee and the other founders of the Mahratta dynasties in India, was originally a bold hunter—then a dacoit, who, having first established himself as a local leader, gradually extended his authority over the whole of Burma, including Arakan, Pegu, and Tenasserim, to the sea and the borders of Siam. His descendants held this empire intact until 1826, when, after the first Burmese war, the provinces of Arakan and Tenasserim were ceded to the British; and in 1852, after the second Burmese war, the province of Pegu and the deltas of the Irrawaddy and the Sittang were further annexed to the same Power.

Causes of the War.—The causes of the late war and subsequent capture of the remaining provinces of the Burmese Empire may thus be briefly stated:—

The Burmese Government advanced an enormous claim against a trading company of British merchants, and absolutely refused the request of the Chief Commissioner to stay proceedings until an impartial investigation of the charges could be made. At the same time, it was

¹ Rangoon, 1887.

more than suspected that King Theebaw was allowing himself to be influenced by European Powers other than the British. The Indian Viceroy required that the King should suspend action in the execution of the decree against British subjects, that he should receive as envoy an agent of the Indian Government, and that he should in future regulate the external relations of the country in accordance with the advice of the Government of India. The Viceroy's ultimatum was contemptuously refused.

The Annexation to India.—On November 14, 1885, a British force crossed the frontier, and on the 28th occupied Mandalay, captured the King, and sent him as a prisoner-of-State to India. On 1st January 1886, by the Viceroy's proclamation, Upper Burma was annexed to the British Indian Empire. Since that time the history of the administration of the province has been one of gradual occupation and pacification.

For some months the experiment was made of utilising the old Burmese Government machinery: the Hlutdaw, the former royal Council of State, was at first retained; but it hardly survived three months.

The New Districts.—The country was thereafter divided into seventeen districts, under charge of civil officers, responsible to the Chief Commissioner.

Instructions were furnished to these officers by the Chief Commissioner; they were approved by the Government of India; and they formed the law of Upper Burma from March till November, when the Indian penal and civil procedure codes were introduced, with modifications, and the parts relating to excise and revenue administration are still in force. "By these instructions each district was placed in charge of a civil officer, who was invested with the full powers of a Deputy Commissioner, and, in criminal matters, with power to try as a magistrate any case, and to pass any sentence. The Deputy Commissioner was also invested with full power to revise the proceedings of any subordinate magistrate or official, and to pass any order, except an order enhancing a sentence. In criminal matters the Courts were to be guided as far as possible by the provisions of the Code of Criminal Procedure, the Penal Code, and the Evidence Act. But dacoity or robbery was made punishable with death, though magistrates were instructed to pass capital sentences only in very heinous cases. In order to provide a safeguard against undue severity in the infliction of punishments, it was ordered that no capital sentence should be carried out except after confirmation by the Chief Commissioner. No regular appeals were allowed from any decision; but it was open for any one who felt aggrieved by the decision of a subordinate officer to move the Deputy Commissioner to revise the order, and for any one who demurred to an order passed by a Deputy Commissioner to bring the matter to the notice of the Chief Commissioner. In revenue matters the customs of the country were as far as possible to be observed, save that no monopoly (except that of precious stones) was allowed, and no customs or transport duties were levied. As regards excise administration, in accordance with the

custom of the country, the sale of opium and of intoxicating liquors to Burmans was prohibited. But a limited number of licences were issued for the sale of liquors to persons not of Burmese race, and the Chinese were specially exempted from the restrictions imposed on the traffic in opium. In carrying out these instructions Deputy Commissioners worked for some time directly under the orders of the Chief Commissioner. In June, however, a Commissioner was appointed for the remote districts of Ningyan and Yamèthin on the south-east of the province, and in August and September the remainder of the province was divided into three Commissionerships. The distribution of divisions and districts is as follows :—

“ The Northern Division 	{	Mandalay.
		Bhamo.
		Katha.
		Ruby Mines.
		Shwebo.
The Central Division 	{	Ava.
		Sagaing.
		Kyaukse.
		Ye-u.
		Chindwin.
The Southern Division 	{	Myingyan.
		Pagan.
		Minbu.
		Taungdwingyi.
The Eastern Division 	{	Meiktila.
		Yamèthin.
		Ningyan.

“ As soon as Commissioners were appointed, the Chief Commissioner delegated to those officers the functions of confirming capital sentences in their divisions, and of revising and superintending the proceedings of District Officers, thus making them responsible chiefs in all departments for their respective divisions.”

This arrangement is practically the turning of the districts of Upper Burma into, what are termed in India, non-regulation provinces—of which the Punjab and Oudh are the most prominent exemplars.

The Shan States.—The Shan States, however—that great group of semi-independent states—are to be treated as “political” territory. That is, they are to be governed by their own chiefs, through British political officers, on the same principle that the Native State Territories in India are governed. “It is proposed that these States should continue to be administered by their own Chiefs or Sawbwas, and that the British Government should interfere as little as possible with their internal economy so long as they keep the peace among themselves, and pay a moderate tribute. Notices

proclaiming these intentions were sent early in the current year to the Shan States, and special communications have been addressed to the principal Sawbwas. It was intended that a Political Officer, with a suitable escort, should visit the Shan country last cold weather for the purpose of meeting with the Sawbwas, receiving their submission, and confirming them in their chieftainships, assuring them of the goodwill and friendly intentions of the British Government, and fixing the revenue payable by each State. It was further proposed that the Political Officer should, with the consent of a friendly Sawbwa, fix his headquarters in a healthy place in one of the principal States, and remain there as permanent Resident and Superintendent. It was found impossible to carry out this programme in the early part of the current year. Meanwhile the shock of the overthrow of the Burmese kingdom has been felt in the Shan States. In some, such as Nyaunggywè, the rulers have been deposed and replaced by successful rivals; in others, such as Thibaw, Monè, and Yatsauk, former rulers, dispossessed of their territories in the time of the late king, have made efforts more or less successful to regain their ancient dignity; in others, such as Thônzè, anarchy prevails. Some Sawbwas have joined the Linbin Prince, a son of the late Einshemin, and therefore a first cousin of the ex-king, and propose to form a confederacy under his sovereignty. Two powerful chiefs, those of Thibaw in the north and of Nyaunggywè in the south, have given in their unqualified submission to the British Government, and may be depended upon to render us active assistance. Other States are wavering. It is possible that, when an English force visits the Shan States, opposition will die away, and order will be restored without difficulty. A Political Officer, supported by a sufficient armed force, was to reach the Shan plateau before the end of January 1887. Our main interests in respect of the Shan States are the maintenance of peace on our borders, and among the Shan States themselves the opening out of the trade routes, and the realisation of a moderate tribute in return for the abolition of the import and transport duties formerly levied on merchandise brought into Upper Burma. The attention of the Political Officer will be devoted to these matters."

Since the Annexation.—The detailed history of all the districts is much the same. The policy was to stamp out dacoity first by flying columns and regular military expeditions. Posts were formed; military police established; robber bands—the only armed resistance—broken up in detail. Peace and quietness is being gradually restored. Confidence in the new Government's determination to maintain order shows itself in gradual revival of trade.

At Mandalay, in the hot weather, many fires broke out, consuming over 3000 houses—about one-tenth of the total number of houses of the city and its suburbs. Though, no doubt, many of these fires were the work of incendiaries, most, it is believed, were accidental, as it is stated that the fires were not more frequent or destructive than in some previous years. But in August a very serious disaster occurred. "The part of

the town of Mandalay which adjoins the river Irrawaddy is protected from floods by an earthwork embankment. In spite of the precautions which were taken by the local Civil and Public Works Officers, the river, which rose to a height unapproached for the past sixty years, broke through the embankment at a place where the engineers and local Burmese officials had not anticipated danger, and inundated all the low-lying parts of the town. Much destruction of property and some loss of life resulted. Arrangements were made the day after the occurrence of the breach to provide food for those absolutely destitute, and soon afterwards a regular system of relief distribution was organised under the Chief Commissioner's orders. Relief works were opened, and all that was possible was done to mitigate the sufferings of those who had undergone loss. The fact that the night on which the inundation occurred was not marked by the slightest disturbance is an indication of the state of order to which the town had been reduced."

Military Losses.—The work of the military expeditions was not done without very serious loss. About 180 encounters were fought, and 11 officers and 80 soldiers were killed in action or died of their wounds. But the climate was more deadly than the enemy. Eleven officers and 919 soldiers died from disease, while 76 officers and 1956 soldiers were invalided.

Police Administration.—The greater military operations being now practically complete, the police administration becomes the most important of the immediate Executive requirements. During the year several levies of military police were formed to take possession of the country conquered for them by the army. These levies were chiefly recruited in Northern India, and from the Gurkhas and other hill tribes, with a small force of native Burmese for detective and purely police duties. They did excellent service in the Mandalay, Sagaing, and Chindwin districts; but in November it was found necessary to enlarge the police force, and "the final recommendations now before the Government of India provide for the enlistment of a force, including the police already sanctioned, of 16,000 men. Of these it is proposed that at first 9000 shall be recruited from India and 7000 from Burma. In the course of time the foreign and local police will each consist of 8000 men. The whole of this force will be subjected to military drill and discipline, and will be enrolled for service for three years. For each district a separate battalion will be formed, consisting of a fixed number of foreign and local police, under the command of a military officer, for the purposes of training and discipline, and under the orders of the local police officers for ordinary police work. The attempt to drill and discipline Burmans, Shans, Karens, Kachins, and other natives of the province has not hitherto been systematically made. The experiment is being tried in Mandalay and, so far, the result is promising. There seems no reason why the natives of Burma should not in time provide a valuable contingent for military police purposes."

Resources of Upper Burma.—Of the resources of the country, which it will be the future privilege of our fellow-countrymen to exploit and develop, but little as yet is really known. “Besides agricultural products, such as rice, wheat, maize, and other cereals, which are grown in many parts of Upper Burma in large quantities, the country was believed to be rich in mineral wealth. A scientific examination of the mineral resources of the province has been begun by the Geological Survey. Pending the completion of that examination, some ascertained facts bearing on the subject may be provisionally recorded. The country about Mogók, to the north-east of the Mandalay district, is the richest, if not the only, ruby-producing tract yet discovered. The ruby mines and the produce thereof are, and always have been, a State monopoly. The inhabitants of this tract are said to have certain undefined rights of working for rubies, subject to their selling all the output to Government or its nominees. One of the first duties of the Deputy Commissioner of the new district will be to verify what the rights of the people really are, and how far they are supported by acknowledged custom or concession by past rulers of Ava. The late King claimed as royal perquisites all the rubies above a certain weight. This claim caused the finders either to secrete or break up the large and more valuable stones. Still, the King used to get from the monopoly a yearly revenue of considerable amount. Arrangements are now under consideration for working the mines either by the agency of lessees or otherwise, and for realising a revenue therefrom.

“Of gold and silver mines nothing trustworthy is known. Gold-washing is practised in the Katha district; but as far as can be ascertained the result is of no great value.

“Jade is found in large quantity, and amber in small quantities, about the head-waters of the Chindwin, the Mogaung, and other higher affluents of the Irrawaddy. The dealers in and the users of jade are Chinese merchants. The stone is a Government monopoly, and the farmer of the monopoly has in past times paid as much as £5000 a year. The jade exported through Lower Burma seaports used to be valued at £60,000 or £70,000 a year, and a good deal went to China *viâ* Bhamo. Very small pieces of jade of the best quality sometimes fetch enormous prices; but, on the other hand, great blocks which do not meet the connoisseur's views go for next to nothing; and the only markets for jade are China and Japan.

“But the most valuable of the Upper Burma minerals is likely to be coal, which is found in quantity at—

- (i.) The Thingadaw coal-field, on the left bank of the Irrawaddy, some 70 miles above Mandalay, and within a few miles of the river;
- (ii.) The Kalè coal-field, about 150 miles up the Chindwin River, and 3 miles from the main stream;
- (iii.) The Panlaung coal-field, with the most accessible known outcrop at Myittha, near Hlaingdet;
- (iv.) More than one place on the Shan plateau.

"Coalfield No. 1 was examined and reported upon by Dr. Oldham, and a consignment of the coal was tried on the King's steamers. Coal from the Kalè field has been burnt this year and in past years on the Chindwin steamers, and is pronounced to be excellent fuel. The seams are thick, and the dip of the strata is moderate. Several tons from the Panlaung outcrop were brought some years ago to Mandalay for trial; but no account of the result of the trial can be found. It may be hoped that, after these coal sources have been inspected and reported on by the Officer of the Geological Survey, who has lately arrived, capitalists will before long come forward to work the coal. When the railway opens to Mandalay there should be an annual demand for 20,000 or 30,000 tons of the Thingadaw coal, if it proves to be good fuel. If a branch railway ever comes to Myingyan, there ought to be an active demand for the Kalè coal. Meanwhile, arrangements have been made for raising and stocking 1000 tons of the Kalè coal on the Chindwin,³ miles from the quarry, for the use of steamers on the Chindwin. It may be hoped that before long the extraction of coal will be started at one or more of the coal-fields described above."

Public Works.—The public works hitherto undertaken have naturally been principally military and police buildings—barracks, hospitals, jails, defensible police posts. Roads and jungle clearing have also been begun. Attention has been drawn to irrigation works, and arrangements have been made for the repair and reconstruction of the Mandalay embankment of the Irrawaddy. "But the most important of the works undertaken or projected during the current year is the railway from Toungoo to Mandalay. Some years back, when the railway was first made to Prome, it was intended to carry the line on to Allanmyo, and it was expected that the railway of the future to Mandalay would be carried up the Irrawaddy Valley. But we have now learnt more of the country beyond Toungoo, and we have ascertained that the hill range known as the Pegu Yoma sinks almost to nothing about Yamèthin. For some time most people acquainted with Burma have been satisfied that the Mandalay Railway ought to start from Toungoo rather than from Prome."

The arguments in favour of the Toungoo route are briefly as follows:—

"The distance from Toungoo to Mandalay is, probably, about 60 miles less than from Prome to Mandalay; the country and the marts along the Irrawaddy Valley are adequately served by the Irrawaddy river, with its steamers and boats, whereas the tract from Ningyan to Kyauksè and Mandalay is absolutely without any means of through communication whatever; it is much better to carry a railway through a land-locked tract without communications than to put it down alongside a fine navigable river; the Toungoo route serves the passes and caravan paths into the Shan States; some of the stations will be within a dozen miles or so of the mouths of the Shan passes, whereas the Irra-

waddy Valley route would be scores of miles from the nearest of the passes into the Shan hills; the Toungoo route is more likely to go near coal¹ sources than the Prome route. For these reasons it seems clear that the Toungoo route is preferable to the Prome and Irrawaddy Valley route.

"Beyond Toungoo the first obligatory point is Ningyan, a town of about 12,000 inhabitants, a place of considerable timber trade, and a mart to which Shan caravans much resort. The line from Toungoo to Ningyan has been surveyed and aligned by the railway engineers. The distance is 59 miles; the levels show a rise of 140 feet between Toungoo and Ningyan; the only large stream is the Swa, which will perhaps require 350 feet of waterway, with two openings of 100 feet. Beyond Ningyan the line must go up the valley, at places barely 15 miles broad, between the Shan hills on the east and the Pegu Yoma range on the west. This valley leads straight to Yamèthin, which is the largest trade mart between Ningyan and towns on the Irrawaddy river. Yamèthin is at the water-parting between the Irrawaddy and Sittang rivers. Yamèthin is probably the highest point on the line to Mandalay; according to barometrical readings, it is about 300 feet above rail-level at Ningyan, or 440 feet above Toungoo. This section from Ningyan to Yamèthin is about 55 miles in length; it crosses two considerable streams, the Ngaleik, close to Ningyan, and the Sinthè, which will require respectively about 600 and 1000 feet of waterway. The line has been reconnoitred, and a traverse has been made from Ningyan to Yamèthin, and the survey of that part of the line is now being pushed on.

"North of Yamèthin the line will take the best and straightest route for Kyauksè. Notes taken from the mouths of natives who know this route seem to show that the line would go by Pyawbwè, Nyaungyan, Wundwin, to a point on the Panlaung river near Myittha, whence it would run straight into Kyauksè. A reconnaissance of the route from Pyawbwè to the Panlaung river has been made, and no high ground has been encountered. This section, from Yamèthin to the Panlaung, may be about 55 miles; it will have to cross the Samôn river, and may have to cross it twice. The Panlaung bridge will not be a formidable affair. The section from the Panlaung river to Mandalay is about 50 miles. This length, from Mandalay to Kyauksè, has been surveyed, and the site for the bridge over the Myitngè has been selected. The several sections stand thus—

¹ It is not possible to be confident about coal sources until they have been examined and tested by competent professional men. Circumstantial reports have been made by Barmese and Shan informants of coal in the Shan States about 20 miles from Hlainglet and of coal on the river Panlaung, within moderate distance of the proposed railway alignment. The truth of these reports was to be investigated in February 1887 by an officer of the Geological Survey. A Shan Sawbwa and a Burmese thugyi both declared to the Chief Commissioner of Yamèthin on the 28th May, that they saw large specimens of coal taken from a pit on the Panlaung River, and carried to Mandalay in the time of King Mindon Min.

	Miles.
I.—Toungoo to Ningyan, already surveyed,	59
II.—Ningyan to Yamèthin, being reconnoitred, well known,	55
III.—Yamèthin to Panlaung River, about	70
IV.—Panlaung River to Mandalay, surveyed and reconnoitred,	50
Add for possible under-estimate or deflections,	6
Total,	240

The cost of the line is estimated at about 183 lakhs of rupees, or, at an exchange of 1s. 6d. per rupee, about £1,372,000. Sanction to its construction was received early in November, and work was at once begun at Toungoo and Ningyan, and a little later at Mandalay. It is hoped that rails will be laid from Toungoo to Ningyan and from Mandalay to Kyauksè before July next. But the achievement of this result depends much on the early arrival of rails from England.

“In connection with the subject of the improvement of communications may be mentioned the steps taken to open up new lines of communication by water. The water routes of Upper Burma consist mainly of the Irrawaddy river and its tributaries; the river Sittang is for a part of the year navigable through a part of the Ningyan district in the extreme south-east corner of the country. The Irrawaddy Flotilla Company have for many years kept a fleet of fine river steamers plying on the upper and lower waters of the Irrawaddy. They enjoy a Government subsidy for carrying the mails and maintaining a regular packet service to Mandalay and Bhamo. The amount of the subsidy was reduced by 30 per cent. in December 1885. Notwithstanding this reduction, the Flotilla Company have done much more for the country since annexation than they did before. They have put on express single-handed steamers to run, once a week each way, between Lower Burma and Mandalay; they run regular weekly steamers to and from Bhamo instead of monthly or fortnightly steamers, as stipulated in the former contract; they have put steamers on short intermediate runs from Mandalay to Kyaukmyaung, and from Mandalay to Myinmu; they have begun to ply regularly on the Myitngé river; and during the rainy season they ran steamers on the Chindwin. All these additional lines are established since the annexation; they are of great benefit to the country; in process of time the Flotilla Company will probably make a profit by them; and two of them are perhaps already paying their way. For these new lines the Company have up to the present time received no subsidy; but they get, as a matter of course, a good deal of Government custom; and a subsidy is to be paid when steamers are run regularly throughout the year on the Chindwin river. A small guard of troops or disciplined police is placed on every steamer. So far, not a single steamer has been attacked either when plying or when anchored for the night. No steamer on the Irrawaddy or its tributaries has been fired upon since the Expedition came up in November last, except the first few steamers that took troops to the Upper Chindwin.

Even on that river no steamer has been fired on since the 8th June, two days before British troops occupied Kindat. To patrol the rivers, to keep down river piracy, to prevent armed bands of rebels or dacoits crossing the rivers, and to facilitate the movement of troops from place to place, there are on the Irrawaddy and its tributaries three large Government steamers and a number of smaller armed launches. Additions to this armed flotilla will soon be made, for at present the native boat trade on the Irrawaddy is by no means safe from river piracy, and the river trade has in consequence declined greatly.

"On the short reach of the Sittang, which is navigable from Toungoo to Ningyan for a few months of the year, the Bombay Burma Corporation, in return for a considerable subsidy, maintained during the wet season a service of light-draught launches. But the depth of river is not constant, and the service worked irregularly."

This is in outline the bare official report of the new province. There are many points on which we would have liked further information, but for which we may have to wait some time. The development of resources—particularly of the noble teak forests, recklessly and wastefully managed under the Burmese Government—will alone demand careful administration. We have heard much, though in a more or less vague way, of mineral resources and stores of earth-oil (Rangoon oil)—petroleum, in other words, and official information must soon reach us of such resources; but, undoubtedly, that which most interests the British public and relegates local development to a second place, is the fact that this last annexation brings our Indian Empire to the frontier of China, and the greatest opportunity of the century is given to us for opening new markets, and reaching the teeming millions of a nation of born traders.

It is only five years since our two townsmen, Archibald Colquhoun and Charles Wahab, worked their way from China to Burma, in the hopes of establishing a trade route between India and China, and already the territory to the Chinese frontier is in our own possession. The scheme of Mr. Colquhoun and Mr. Holt Hallett, of connecting Burma and China by a railway from Moulmein, through Siam and the Siamese and Burmese Shan States, is undoubtedly the great scheme before the country. It was fully explained by these gentlemen last year to the Scottish Geographical Society.¹ Since then, China has declared for railways, and this has made the scheme still more practicable. That the difficulties—financial and political, rather than physical—may be great, is true, but they are surely not insurmountable; and the result would be an enormous impetus to the languishing trade of Great Britain,—the scheme being worthy of the most earnest attention of every one interested in the development of British industries. Government does not yet countenance the scheme;

¹ *Scottish Geographical Magazine*, vol. ii. p. 78.

but it must be remembered that, in the ultimatum addressed by the Government of India to King Theebaw, one of the points was "to afford facilities for opening up British trade with China;" and if Theebaw were required to do this, much more were our own new Government bound to promote any practicable scheme.

W. B. B.

[*Note.*—In connection with this subject should be read Mr. Holt Hallett's Address to the Birmingham Chamber of Commerce, May 1887, entitled *Burmah, our Gate to the Markets of Western and Central China* (London: P. S. King and Son), in which the subject is fully discussed.]

MR. FULFORD'S JOURNEYS IN MANCHURIA.

THE following details of a journey in Manchuria are excerpted from Mr. Fulford's Report, recently published as a Parliamentary Paper, *China*, No. 2, 1887 [C. 5048]. Mr. Fulford, a Student Interpreter, started from Ying-tzu (Ying-tza of the map), a town near the Gulf of Liao-Tung, and passing by Mukden, travelled across country to the valley of the Yaloo. This he reached at Mao'erh Shan, where it is a fine stream 300 yards broad, with a maximum depth of 12 feet. As there proved to be no road up the valley by which he could proceed to Hunchun, he struck across a spur of the Long White Mountains (Shan-a-lin) to the upper valley of the Sungari, one of the important tributaries of the Amur. This ridge, which had a height of 2600 feet, was well wooded with fir, elm, oak, plane, walnut, birch, larch, and pine, and a thick undergrowth. The highest portions are inhabited by a republic of hardy hunters, mostly from Shan-tung, who, finding no sufficient protection at the hands of the Chinese authorities at Kirin, have formed themselves into guilds, who promulgate stringent rules in regard to robbery and harbouring bad characters, as well as in regard to the inroads of Coreans from across the border. At Tang-ho Kow is the meeting-house of the guild of the surrounding country. A detour was made to visit the sources of the Sungari, which are thus described:—"On the summit of the Pai Shan, about 8000 feet above the sea, lies an extinct crater, the pumice from which extends down the sides of the mountain for 1000 feet, and gives it the whitish appearance to which its name refers. The view from the crater's edge was well worth the toilsome climb—the vivid blue of an immense lake suddenly bursting on the sight, and contrasting with the majesty of the high white cliffs. An outlet was visible in the north, which the guide said was the source of the eastern branch of the Sungari. From the slope where we stood (the western) flowed the western branch. The two join about 70 miles north of Tang-ho Kow." In the journey to this crater the travellers had a severe experience of the virulent character of the insects of the district—midges, mosquitoes and gad-

flies. "No description," says Mr. Fulford, "can do justice to the midges. In full sunshine they are scarcely bearable; and in the shade and at night they grant no peace. The people wear hoods, leaving a round hole for the eyes and mouth, and further protect themselves by a piece of smoking bark suspended from the front of their caps. Their animals must also be provided at night with densely smoking fires, by standing over which they may gain some relief. The hunters' huts are so filled with the pungent smoke of the birch wood they use to cook their food, that they are free from the nuisance. At every halt in the forest a small fire is lit, around which the men may have a quiet pipe." Proceeding down the Sungari valley to Kirin, the chief town of this part of Manchuria, Mr. Fulford, after almost a month's detention by the rains, continued to journey northward as far as Tsi-tsi-har (Pu-Ku-li in Chinese). From this town, surrounded by a mud wall some 5 miles in circumference, he travelled south-east to Hulan, a distance of 200 miles across the well-grassed steppe. The population proved exceedingly scanty, groups of eight or ten Mongol huts occurring at a distance of 20 miles. Here and there a soda-boiler found the material of his trade in the surface soil. The town of Hulan was reached on September the 29th. It is the capital of a wonderfully fertile district extending 100 miles in length, between the Sungari and its tributary the Hulan; and at present it is the focus of an important immigration from the south. The number of large distilleries in the district is very remarkable; and the spirit, prepared from millet, is sent to all parts of the country in wickerwork jars. Besides, the distillery buildings, surrounded by strong walls, serve as fortified trading posts, of no small value in a region where insecurity of life and property is the great obstacle of progress. "Along the whole of our route," says Mr. Fulford, "we found nowhere a distinct Manchu population. It seemed that the Manchus were collected in the principal towns, such as Kirin, Petunah, Tsi-tsi-har, Ninguta, and that the number of Manchu agriculturists must be very small." Travelling along the north bank of the Sungari, over undulating country mostly uncultivated, with mountains close by on the north, the party arrived at San Sing, 200 miles east-by-north from Hulan. The business of this town of 10,000 inhabitants was chiefly in furs and in fish, of which the ta-ma-ha (a sort of salmon) and the sturgeon were the most remarkable. It is this ta-ma-ha which plays so great a part in the economy of the Fish Skin Tatars, who eat its flesh, burn its oil, and dress in its skin. Striking southward up the valley of the Hurka, Mr. Fulford proceeded to Ninguta, a frontier town which has recently grown to a population of 30,000, and is a station on the telegraph line from Mukden *via* Kirin. From Ninguta a cart road—a very bad one, it is true—leads to Hunchun. This is a town of 5000 inhabitants, owing its existence to its situation as the frontier town on the Russian and Korean border. Trade, says Mr. Fulford, is now allowed freely with the Koreans, who cross the boundary (the Tumen) as they please. A few are farming on the northern bank. They are treated with contempt by the Chinese, who invariably

address them as "Men of the Little Nation," while they style themselves as "Men of the Great Nation." Both the Hunchun and the neighbouring Russian district depend mainly on the Koreans for their supply of beef. Little else but cattle, some indifferent fruit, and a small amount of grain is sold by the Koreans at Hunchun. They get in return manufactured Chinese goods and foreign articles. Crossing the Hunchun by a ford, the travellers found themselves, after a level ride of six miles, on a low watershed between that river and the streams falling into Possiet harbour; and there, in an inn yard, they saw the brass pillar erected by the Imperial Commissioner Wu Ta Cheng in commemoration of his negotiations last year in settlement of the disputed frontier. The Russian outpost of Schwanka is known to the Chinese as Heng-ta-ho-tzu; the forces now stationed at Nova Kyiosk (*i.e.* New Kiosk) or Yeu Chi-ko will be removed to the new fort as soon as the barracks are ready. After visiting the Russian authorities, Mr. Fulford returned to Hunchun; and thence he returned to Kirin. "From Kirin," he writes, "we took the road to Kuan Ch'eng-tzu, 80 miles north-west, being desirous of seeing that busy trading town. It is situated on the I-tung river (a small tributary of the Sungari), has low mud walls, one big street two miles from north to south, and four streets running east and west, the longest three miles. The population may be estimated at 70,000. It has on the north and west a fine agricultural district, extending 50 miles west to the Mongolian prairie, of which it once formed part. It is now treated in the same way as the Mongolian portion of Tsi-tsi-har, rent being paid to the Mongol princes. Chinese officials have been stationed here recently to govern the Chinese population. . . . From Kuan Ch'eng-tzu we visited the French mission-station at Hsiao-pu-chia-tzu, a village of about 1,000 inhabitants, all converts." Passing onwards by Ta-pu-chia-tzu and other well-known places, Mr. Fulford reached Mukden on 11th December, and was hospitably entertained by the Scottish Presbyterian Mission. The name of Mr. Ross, he says, is widely known both in the city and as far as the Korean border on the east, and Dr. Christie's hospital is highly valued both by the officials and the people.

Mr. Fulford supplies several curious details about the cultivation of the poppy in Manchuria, where it is subjected to no restriction. In the country near Hulan opium takes the place of money as a circulatory medium. Foreign opium is little used; besides being dearer than the native article, it does not last so well; and it has been practically driven out of the market. As regards the minerals of Manchuria there is not much to report—a little gold-washing, a little iron-smelting, and a little coal-mining. The travellers were struck by the absence of archaeological remains in the district they traversed. The political instability of the country, and the severity of the climate, with its heavy rainfall and resulting denudation, are no doubt responsible for the disappearance of ancient cities. All that is left of the old town of Tung-Ching-Cheng (the capital about 1000 A.D. of the powerful kingdom of Bohan), are the ruins of the

walls, some thirteen miles in circumference, composed of lava rubble in disintegrated masses.

In taking leave of this most interesting report, we cannot refrain from condemning the extreme carelessness which characterises the geographical editing of our Parliamentary papers. It is quite impossible to trust the form of a proper name either in text or map. Were it merely that one variant of a name appeared in the map and another variant in the text, the discrepancy would be too common and unimportant to attract attention ; but what can be said when, in a brief report like the present, the Hunchun of the text is the Hanchow of the map ; and other places appear as Nova-Kyesok and Nova Kylosk, Ning-ta and Nin-guta, Nicolsk and Nicolok, Pei-tuan-lin-tzu and Pei-tuan-lin-tyn, Ying-tzu and Ying-tza, Wei-tzu-hu and Wei-tyn-hn. It is a disgrace to the Government Office which permitted such inconsistencies to pass. Somebody, it is to be supposed, has received public money for attending to the proof-reading of this document, and the public has a right to insist that this "somebody" performs the work for which he has been paid. Or, perhaps, it is nobody's business, and the maps issued by the British Government are supposed to correct themselves. At any rate, as the result of many years' severe experience, the present writer would recommend no young geographer to trust a Government Blue-book form of a geographical name, unless he has means of testing its accuracy. That this should be the condition of affairs is all the greater pity, because the matter of the Government Blue Books is often of primary importance. If the blundering appeared only in reports referring to districts where the names were absolutely new to geographers, one could perhaps excuse a certain percentage of mistakes as due to bad penmanship in the original ms. ; but it is absolutely impossible to ascribe to anything but the most arrant and culpable carelessness, the kind of blunders which from time to time deform our Government publications,—names of well-known geographical places spelt in several utterly irreconcilable methods, due to no variety of dialects or discrepancy of transcription, but to heedless printing, subjected to no sufficient process of instructed proof-reading. The mistakes would sometimes lead one to suppose that the documents by which they are disfigured were produced by some hedge-side press in a district of political disturbance rather than by the authorised printing-presses of one of the oldest and wealthiest governments in Europe. One has frequently wondered at the reluctance of the British Government to practise the same liberality with its Blue Books as foreign Governments show with theirs ; but when one takes into consideration the character of their geographical nomenclature, it is a pleasant and charitable course to suppose that their reluctance to promulgate their documents arises from a laudable and most natural desire not to multiply and perpetuate the evidence and examples of their own inefficiency.

GEOGRAPHICAL NOTES.

ASIA.

The Climate of Corea.—In the May number of the *Meteorologische Zeitschrift*, Dr Woeikof discusses the climate of Corea in connection with that of Japan on the one side and Eastern Asia generally on the other. The data for the peninsula are those published by Dr. C. Gottsche in his *Land und Leute in Korea*. The yearly period of atmospheric pressure is much more marked in Corea than in Japan. At Fusan the mean pressure, reduced to zero and sea-level, was, for June and July 768·7 mm., and for December and January 756·5 mm.—a range of 12·2 mm.; while for Japan the range is only about 5 mm. The yearly amount of cloud is very much less than in Japan, and like the rainfall it shows a distinct monsoon character; most rain falls between May and September, and although the number of wet days is not great, when it does rain it rains very heavily. In winter the prevailing winds are W., NW., and N.; in summer SW. and S. are most common; the monsoons are not, however, very strongly established, and local land and sea breezes are not prevented. The east coast of Corea has a relatively high temperature compared with the west coast. Thus, although Wönsun, on the east coast, lies two degrees further north than Chemulpho on the west, its mean annual temperature is 1°·3 F. higher than that of the latter, and the annual range of mean monthly temperature 41°, instead of 54° as at Chemulpho. In 1884-85 the maximum temperature of the summer was in both places 89° F.; but the minimum in winter was 14° F. at Wönsun, and as low as 2°·8 F. at Chemulpho. This remarkable difference is explained by reference to a phenomenon previously pointed out by Dr Woeikof, that where the mountain ranges of the eastern Asian coast are broken by valleys, the cold air of the high plateaux flows down, and reduces the temperature of the coast land.

In the Country of the Moïs, Cochín-China.—Early in the year 1884 a M. B. Humann made a short excursion into the country inhabited by the independent Moïs, a region situated on the upper part of the river Lagna, and extending to its sources. Leaving the village of Tracu-ha, situated on this river, on 20th February, the traveller crossed the watershed (about 400 feet) separating the basin of the Lagna from that of the Da-Hue, an affluent of the Donai. The valley of Tapoo, into which he descended, is rich and fertile, being surrounded by hills, which vary in height from 1000 to 2620 feet. Passing up the enclosed valley of the Da-Mrè, a tributary of the Da-Hue, M. Humann crossed again into the basin of the Lagna, by a pass (2600 feet) between two hills, which form part of a chain, whose north-north-east versant gives rise to the feeders of the Lagna's main tributaries. At first the route led across broad and slightly undulating plateaux, between 2450 and 2600 feet high; then came magnificent forests of pines, many of which measured 10 feet in girth, and grew to a height of 50 to 60 feet. The furthest point north reached by the traveller was the village of Draï, situated at the foot of the Yan-Yut range, from an elevated valley of which the Lagna takes its origin. The country thereabout is of an irregular contour, with fine forests and a vigorous population. On his return journey, M. Humann followed the course of the Lagna, crossing on its left bank a number of tributaries, which plough their way along broad plateaux stretching east and north-east, right away to the foot of the mountains of Binh-Thuan. The soil of this region seems to be fertile, but the population is sparse, and live in continual fear of the incursions and exactions of the Annamites. At a village called Challao, where

the plateaux cease, the Lagna becomes a broad torrent, and winds its way through a labyrinth of picturesque mountains. This country is thickly peopled, and contains numerous prosperous villages; for the Moïs, feeling themselves secure amongst the mountains, here practise industrious habits. — *Comptes Rendus de Soc. de Géogr.* (Paris), No. 11.

Provinces of Binh-Dinh and Phu-Yen (Annam).—The ways of geographical nomenclature in Annam, Cambodia, and Tong-king are so perplexing and tortuous, that we are often repelled by the mere *chevaux de frise* of uncouth names which an article on those countries presents. Hence, when we get an opportunity to study one which is less formidable in this respect, we hasten to avail ourselves of it, for the profiting both of our own and our readers' knowledge. In the sixth part of the *Bull. de la Soc. de Géogr. Comm. de Paris*, for 1887, there occurs a paper by M. C. Lemire, treating of the two provinces of Binh-Dinh and Phu-Yen, which falls under this category:—

Binh-Dinh.—This province is situated in the centre of Annam, and extends for nearly 90 miles along the Chinese Sea, being bounded on the north by the province of Kwang-Nai, and on the south by that of Phu-Yen. It is traversed from end to end by the "Mandarin Road," which varies in width from 10 to 22 feet, and could easily be made serviceable for wheeled vehicles throughout its entire length. The province is very mountainous, the ranges approaching each other very closely. Its population numbers about 1,200,000. None of the rivers are navigable. The principal ports are Qui-Nhon (or Thinaï), situated in 106° 53' E. long., and 13° 45' N. lat.; Nuoc-Ngot (or De-gi); and Kim-bong, at the mouth of the river Tan-Kwan. The first-named stands on the mainland side of a strait, at the entrance to a long (1970 yards) and narrow (660 yards) bay, which is parted from the sea by a spit of sand-dunes. The port, however, is sanding up, the entrance to the bay being only 17 feet deep. The capital of the province is Binh-Dinh, lying 11½ miles north-west of Qui-Nhon. It contains a citadel, in which are included the royal palace, that of the governor, barracks, and other buildings. The imports and exports of the province are each valued at about £40,000 annually; the commerce is, however, confined to the hands of five or six hundred Chinese. The chief productions include oil, earth-nut cakes, silk, sugar, salt, vermicelli, beans—all destined for export—and rice, which is consumed in the province itself. Annam suffers greatly from the want of good roads and other means of communication. Merchandise has to be carried on men's shoulders, and has to be got across deep and rapid rivers by means of dangerous fords. A special industry—confined, however, to two villages—is the manufacture of crepon. The province has suffered a good deal in its industrial and commercial relations from the troubles of which it was the scene in the years 1885 and 1886.

Phu-Yen.—The province of Phu-Yen, stretching from Cape Varela on the south to Pulo-Bambier on the north, lies between 106° and 107° E. long., and 12° 50' and 13° 40' N. lat.; it is bounded on the north by the province of Binh-Dinh, and on the south by that of Khanh-Hoa. Being a maritime province, its eastern boundary is, of course, the sea. The western boundary is undetermined, the population not extending inland for more than 11 or 12 miles. Administratively, it is conjoined with the province of Binh-Dinh. Its coast is broken by two deep but unsheltered bays—that of Cumong, 10½ miles south of the town Qui-Nhon, and that of Xuan-Dai, 28½ miles from the same port. The shores of the former bay are studded with villages embowered in cocoa plantations, and their inhabitants are engaged in the manufacture of salt, in weaving cotton, and in making

ropes from the fibres of the cocoa-nut tree. The Bay of Xuan-Dai receives the waters of the river Xuan-Dai or Song-Cha, a tributary of the Ba, *not* of the Song-Ba or Da-rang, which rises in the mountains of Binh-Dinh, and flows past Anké, and which is itself a tributary of the Ba. The commercial centre of this bay is Vung-Lam (situated on the entrance strait), which carries on an active trade with Binh-Thuan and Saigon. The place which the French have chosen for their commercial establishments and for their port is called Song-Cau—a place not yet shown on the map, but lying almost at the head of the bay. Between the shore and the foot of the mountains in the background stretches a broad plain, with numerous clusters of fruit-trees, fine gardens, and deserted patches of cultivable land. The downflow of water from the hills is conducted in a longitudinal cistern and a channel arched over with bricks. The hills consist of three successive chains, on the lower slopes of which plantations, farms, and fruit-gardens rise one above another in terraces. Below on the plain grow mulberry-trees, the sugar-cane, maize, beans, tobacco, rice, sweet potatoes, and pimento; and of trees, the mango, tamarind, *Carambola*, pomegranate, *Camellia*, lemon, banana, cocoa, pepper, areca palm, bamboo, banian. Teak grows on the mountains. The population is a race of intrepid seamen, yet averse to labour.

AFRICA.

The Emin Pasha Expedition.—General Strauch, of the Congo Free State, sent the following telegram from Brussels on 20th July to Mr. W. Mackinnon:—"A telegram from St. Thomas informs me of Stanley's arrival at the river Aruwimi, and his departure thence on June 2d for Wadelai." Mr. Stanley had intended to disembark his expedition at the Aruwimi unless the state of the river Congo were favourable for proceeding up to Stanley Falls. He had with him a son of one of the chiefs of the Aruwimi district, and, it was said, acquired from him, prior to leaving England, a mass of information respecting the country between the Aruwimi and Wadelai. Tippu Tib's knowledge ought also to be of service. Mr. Stanley is three weeks beyond the date at which, when in England, he estimated his land journey should commence.

The statement from Matadi that Mr. Stanley had been killed in a combat with the natives seems scarcely credible in the light of more reliable information that has reached this country of the progress of the expedition.

Overland from Banana to Boma.—Baron von Schwerin, whose explorations of the river Nkissi or Inkissi we noticed in our issue of March last, has since then executed another exploring journey, this time by land, from Muanda, a coast-village situated a little to the north of Banana, to Boma, inland, by way of the agglomerations of villages to which the names Chim Buanda, Kakongo Songo, and N'Lelle are given. Proceeding inland about 6 miles in a north-east direction, Baron von Schwerin came to the foot of the terrace (200 feet high) which runs almost parallel to the coast. Its base consists of laterite, covered with sand. It is intersected by several broad and deep valleys, plentifully wooded, and planted with numerous prosperous villages. These valleys yield also the cachou fruit (which is about the size and has the colour of the lemon), and copal gum. After ascending the terrace, the country consists of a series of open savannahs, studded with thickets of trees, and of fine forests full of excellent timber, the whole resembling a succession of English parks. Here grows the *Erythrophlæum guineense*, which yields a very powerful poison. At Kakongo Songo, which lies in the midst of an extraordinarily fertile region, the explorer turned towards the

south-east, and soon came to N'Lelle, which is famous all the way to the coast for its pottery. The basin of the Congo was entered by the river Kuilu, a left-hand affluent of the Lukunga (called also the Paciconde and Loango River), which pours its waters into the Congo behind the island of Mateba. The Lukunga is the most important right-hand tributary of the Congo below the Falls. It marks pretty accurately the dividing-line between the crystalline schists on the east and the alluvial region on the west; on its right bank the country is flat, whilst on the left begins the hilly region. The basin of the Kuilu contains many fruitful valleys of great beauty, growing innumerable magnificent specimens of the Guinea palm, whilst the slopes and ridges of the hills are clothed with virgin forest. This district is rich in palm-oil and red dye-wood. Caoutchouc is plentiful in the forests, but is not appropriated by the native population. The wild coffee-tree is also reported to grow here. But on entering the country of Boma, a wonderful change takes place. Instead of verdant valleys and forest-clothed hill-sides, the eye is met by grassy slopes, showing patches of bare laterite; the pathways are strewn with pebbles; there are groups of half-withered palm-trees, and isolated baobabs; the rivers become marshy and muddy, and grow vast quantities of papyrus.—*Le Mouvem. Géogr.*, 19th June 1887.

Ascent of the River Lopori by Captain van Gèle.—This right-hand affluent of the Lulongo, a tributary of the middle Congo, explored two years ago by Messrs. Grenfell and Von François, was recently ascended by Captain van Gèle in the *Henry Reed* steamer. At its mouth the Lopori has these dimensions:—breadth, 550 yards; depth, 8 feet; rate of current, $1\frac{1}{2}$ miles an hour; volume of discharge, 211,900 cubic feet. In the lower part of its course its general direction is from north-east to south-west. Immediately above its embouchure navigation is impeded at low water by numerous sand-banks. A range of quartz hills skirt the left bank of the river, at a short distance from it; their average elevation is about 130 to 165 feet. The banks in the lower part of its course are low and but sparsely inhabited; but there exist numerous indications that a dense population dwell in the interior. After proceeding up-stream for six days, the explorer found the river began to be very sinuous, and its channel choked with dead trees. In the meridian of Upoto (on the Congo) the Lopori gradually approaches the left bank of the Congo, until a chain of hills on its right bank abruptly deflects its course. Captain van Gèle turned back at the village of Ikengo, where the river was 66 yards wide, $11\frac{1}{2}$ feet deep, and came from the south-east at the rate of $1\frac{1}{2}$ miles an hour. In all parts of its basin elephants are very numerous.—*Le Mouvem. Géogr.*, 3d July 1887.

The Magwangwara.—This is the title of an interesting and instructive paper read last October before the members of the Manchester Geographical Society, and published in the second volume (the last issued) of that Society's Journal. The paper is from the pen of the Rev. W. C. Porter (of the Universities' Mission to Central Africa), who, starting from his headquarters at Masasi, twice visited the country of the fierce and warlike tribes comprehended under the general name of the Magwangwara. He is unable to define with precision the boundaries of the territory over which they are spread, but, referring to those tribes to which the name is more specially applicable, he thus writes:—"We may say that their south boundary is the river Rovuma; that on the west, Lake Nyassa, or the great Livingstone Range on its north-east shore; on the east, the wide extent of the country which they have depopulated between $9\frac{1}{2}^{\circ}$ S. lat. (nearly

the lat. of Kilwa and the northern end of Lake Nyassa), and the river Rovuma (i.e. about $11\frac{1}{2}^{\circ}$ S. lat.); and as far east as the longitude of Majeje Hills (about 38° E.). The northern limit is harder to discover." Such is the territory which they occupy when at home, but they make periodical raids into the country which extends from their eastern frontiers towards the sea, and, along with the Maviti, a more southern tribe, they are the curse of that portion of Eastern Africa, and the great bar to its peace and prosperity—murder, famine, and slavery being the usual result of their predatory habits. Their prowling bands, moreover, infest the direct route which leads from the coast to Lake Nyassa, and hence that route is now regarded as impracticable. The Mission Station, Masasi, is situated inland at a distance on the one side of 120 miles from the seaport of Lindi, and on the other of about 300 miles from the headquarters of Sonjela, the greatest chief of the Magwangwara. Mr. Porter twice visited this chief for the purpose of ransoming a number of people who in the course of his raids had been carried off from Masasi, and reduced to a state of slavery. On both visits he proceeded by the same route as far as the hill Majeje, which is somewhere about 12 miles distant from the river Rovuma. On the first occasion he pursued from Majeje quite a direct route running in a north-west direction towards the northern extremity of the lake, but on the second occasion his route was more circuitous, and more to the south, and lay at first along the course of the Rovuma. From a Yao chief, who resided on an island in that river, he procured a guide for his journey through the desolate forest—a journey of 220 miles, which it took him sixteen days to accomplish. The route was intersected by numerous streams, which, in one or two instances, were of considerable size. On the morning of the sixth day the party reached the river Lusasawara (marked in the R. G. S. map), and in the after-part of the same day crossed the track of Dr. Roscher, who, in 1859, had penetrated from the coast to the Rovuma. On the twelfth day they came to the river Luchimwa (also marked in the R. G. S. map), which has a swift and clear stream in a wide sandy bed, and is a fishing resort of the Magwangwara. On December 1st they crossed a considerable stream called the Mjuga, and on the following day reached their destination. The dusky chief received his pale-faced visitor in a friendly spirit, surrendered his captives on receipt of an exorbitant ransom which was paid in cloth, and signified his willingness to receive a teacher from the Mission should one be sent. After a stay of twenty-seven days the party started on the return journey, which was made by the more northern of the two routes. The country is described as being rich in cattle, corn (chiefly maize), vegetables and flowers; and among the wild animals are specified elephants, lions, gnus, gazelles, porcupines, and wild pigs. Mr. Porter would place Sonjela's village considerably more north than it appears in the maps hitherto published, assigning its position, though not from scientific data, as $10^{\circ} 40'$ S. lat. About 15 or 20 miles to the south-west of it is Mhaluli, the chief town of the southern division of the Magwangwara. Some of his men went there; and it is particularly interesting, he says, as near it there seems to be the source of the river Rovuma. The paper is illustrated with a sketch-map of the Magwangwara district.

AMERICA.

The Origin of the name "America."—To a recent number of the *Bulletin* of the American Geographical Society (No. 4 of 1886) Mr. G. C. Hurlbut has contributed an interesting paper on this topic. The name, he says, appeared for the

first time in the *Cosmographiæ Introductio* of Waldseemüller, or Waltzemüller (Hylacomylus), of St. Dié, in the Vosges. In this book, which was published in 1507, Waltzemüller says again and again that he gives the name *America* to the New World because it was discovered by Americus Vesputius. This name became in 50 years the recognised name of the western continent, except in Spain, where the official designation of "The Indies" held its ground. Vespucci made two, or, as some say, four voyages to the New World, and published accounts of these, along with charts which he either drew or corrected. He did not, however, either in his writings or in his charts, apply his name to the regions which he described. The obloquy therefore from which his memory has so long suffered—that he usurped the honour which of right belonged to Columbus—is now all but universally acknowledged to have been totally undeserved. From the work of Waltzemüller referred to, Mr. Hurlbut quotes several passages bearing on his subject, and of these we subjoin two: "The Ceylonese, the Ethiopians, and the greatest part of the still unknown land, lately discovered by Americus Vesputius. Concerning this there are subjoined the accounts of his four voyages, translated from the Italian tongue into French and from French into Latin." "And now these parts (Europe, Africa, and Asia) have been more fully described, and another fourth part has been discovered by Americus Vesputius (as will be learned further on), and I do not see how any one can with reason object to calling this Amerige—that is, the land of Americus, or America, after its discoverer Americus, a man of excellent parts: since both Europe and Asia happened to get their names from women. The situation of this part, and the manners of its people, will be clearly understood from the account of the 4 voyages of Americus, which follows." Four editions of the *Cosmographiæ* were brought out at St. Dié in 1507. One in Latin and one in German appeared at Strasburg in 1509; and the last of all at Lyons in 1517 or 1518. Some five or six years, at least, before the appearance of the last edition, Waltzemüller had become aware of his error with regard to the discoverer of the New World, for in a work largely his own, printed in 1513, there is a line which assigns the discovery to the "former Admiral of the Most Serene King Ferdinand of Portugal." By the *Admiral* here must be meant Columbus, for Vespucci, who died in 1512, never bore that title, while *Portugal* is an evident mistake for Castile, since the King of Portugal at that time was Emanuel the Great. Mr. Hurlbut next shows (from Varnhagen) how very generally the name of America bestowed by Waltzemüller was accepted, specifying no fewer than twenty works of a geographical nature, published in various countries of Europe before the middle of the 16th century, in which that name was applied to the New World. In several of these works it is expressly stated that Vesputius had discovered the New World, and that the name of America was given to it for this reason. Waltzemüller's declaration that such was the origin of the name must have sufficed, one would think, to set the question for ever at rest. Not so, however, for in 1875 Mr. J. Marcon, a distinguished American geologist, reopened the subject by advancing an ingenious argument in favour of the native origin of the name *America*. The argument may be thus briefly stated: There exists between Juigulpha and Libertad, in the province of Chontales in Nicaragua, a chain of mountains known by the name of Amerrique, Amerique, or Americ, which stretches on one side into the country of the Carca Indians, and on the other into that of the Rama tribe. From these mountains descend numerous rivers, which flow, some into Lake Nicaragua, and others, as the Blewfields and the Grande Matagulpa, into the Atlantic. Now Columbus, on his fourth and last voyage, reached, on the Mosquito coast, the river which

he called the Rio del Desastre, and which Marcon identifies with the Grande Matagulpa. Some days after, Columbus stopped for a time at a place called Cariay, near the mouth of the river Blewfields, where he inquired about gold, and learned that it abounded in several places which were named to him. These places were situated in a region through which ran the Amerique chain of mountains, in which there are gold mines which are still worked. Columbus mentioned only the province of Ciamba; yet it seemed to Marcon most probable that the Indians often spoke of Amerique, or Americ, and he holds it to be almost certain that they answered the continual question as to the source from which the gold was derived by saying that it came from Americ. When the Spaniards returned to Europe, they probably boasted of having discovered mines of gold, meaning those in the region of Amerique, and this strange name, repeated from mouth to mouth, travelled through Spain and beyond the Pyrenees until at last it reached Waltzemüller at St. Dié, who, not knowing the significance of the word, supposed it to be derived from the name Albericus Vesputius, whose account of the New World was the only one with which he was then acquainted. "To support this derivation," says Marcon, "it was necessary to twist the name of Vesputius into the form *Americus*, and this Waltzemüller did not hesitate to do, though in calling the New World after the baptismal name of the supposed discoverer, he was violating the rule which makes this an exclusive privilege of crowned heads. If named after Vesputius, the New World ought to have been called Vesputia, and not America." The only explanation of this inconsistency is, in Marcon's opinion, the fact that Waltzemüller had heard the name Amerique before associating it with Vesputius.

This theory Marcon put forward almost simultaneously in America and in Europe, but it did not attract immediate attention. When at last it was subjected to critical examination, all the evidence was found to be against it. The first and sufficient objection to it is that it does not take into account Waltzemüller's repeated declaration that the name *America* was made by him from the baptismal name of Vespucci. Were it even admitted that he might have made a mistake when he wrote the name, and that it was brought by the Spaniards from the New World, how is it to be explained that no one of them has left a hint of it in any writing or tradition in or out of Spain, the name not being found as a native American name in any record of the sixteenth century? Whether Columbus ever heard of the Amerique chain or not, it is to be noted that map-makers, as if by common consent, leave it out of their maps. It might be supposed, therefore, that Marcon created these mountains out of his inner consciousness. This would, however, be doing him an injustice, for there does exist in the province of Chontales, in Nicaragua, a chain of mountains called by the name of the *Amerrisque* range. He seems to have been led into error by a mistaken spelling of the name. With regard to Vespucci's baptismal name, it is shown, both by letters which were written to him and by his own signature, that it was *Amerigo*, and not *Albericus*, as Marcon supposed. Finally, Marcon's observation that the continent, if named after Vespucci, ought to have been Vespuccia, is answered by an appeal to Humboldt, who says: "The preference shown by Waltzemüller for the prænomén over the family name of the Florentine navigator, is easily explained by the inferior sonorousness of the name Vespucci and its derivative Vespuccia, as well as by the Italian and Spanish custom of indicating distinguished persons by their baptismal names." None of the works published by Vespucci now exist, but some letters of his to two friends are extant, and in these he gives notes of his voyages and of the strange people he had seen.

Sources of the Orinoco.—Besides *M. Chaffanjon*, of whose expedition for the exploration of the origin of the river Orinoco we have already given intimation, we learn from the *Bollettino della Soc. Geog. Italiana* (May 1887), that an Italian expedition, under the leadership of Count Stradella and Marquis Serra, is about to proceed, under the auspices of the Italian Geographical Society, to South America, for the purpose of pursuing the same investigation. The principal leader of the undertaking, Count Stradella, is eminently qualified for his duties by a long course of travel and exploration carried on in the equatorial regions of the same continent, between the years 1879 and 1885. The Count has not yet published any account of his travels, consequently the importance of his labours runs some risk of being overlooked; but, judging from the few facts respecting them which have become known, they are doubtless of considerable value for the geographer, and especially for the student of the northern and central portions of South America; for his journeys took him on the rivers Purus (and two of its tributaries), Jurua, Rio Negro, Haupes, Tikié, Padauri, Marary, Castagno, Giurapari, Uaupes, Tapo, Apipuri, and Jauaperi, some of which he traversed almost in their entire length. He also accompanied, as a volunteer, the Commission which delimited the frontier line between Venezuela and Brazil (see April No., pp. 201-203) on behalf of those two Governments.

Province of Paraná, Brazil.—This, one of the most prosperous of the southern provinces of the vast empire of Brazil, has an area of 90,490 square miles, and a population numbering nearly 215,000. Lying between $22^{\circ} 10'$ and $27^{\circ} 16'$ S. lat. and $48^{\circ} 3'$ and $54^{\circ} 27'$ W. long., it is bounded on the north by the province of São Paulo, on the east by the Atlantic, on the south by the provinces of Santa Catarina and Rio Grande do Sul, and on the west by the province of Matto Grosso, the Argentine Republic, and Paraguay. The coast-line is about 62 miles long. The coast region constitutes a belt about 20 miles wide. The country then rises rapidly into the Serra do Mar (highest point Mount Marumby, 5940 feet), which sends out two secondary chains towards the coast, Serra Negra in the north, and Serra da Prata in the centre. In respect of contour, the province of Parana consists of three terraces or broad plateaux, rising one behind the other, as one recedes from the coast; the last of these slopes down gradually towards the river Parana. Access is given to the first plateau through the Serra do Mar by three passes, 2950 to 3100 feet above sea-level. This plateau has a breadth of about 43 miles, and then suddenly rises into the Serrinha, a chain running parallel to the Serra do Mar, and attaining its maximum height in a peak of 3990 feet. This range falls away on the south and west to the second plateau, the elevation of which is about the same as that of the first plateau. At the ridge of the Serrinha begin the pasture-plains known as Campos Geraes, which measure 50 miles from east to west, and 75 from north to south. The second plateau extends westwards for 115 miles, to the foot of a third mountain wall, the Serra d'Esperanza (3936 feet). Behind this comes the third plateau, which lies some 490 feet higher than the first two, and slopes gradually away till it is not more than 750 feet above the level of the sea. Across it runs the Serra São João (3445 feet), forming a wide curve. The coast is broken by three bays. Hydrographically, three systems may be reckoned—(1), that of the Atlantic; (2), that of the river Parana; and (3), that of the Uruguay. In respect of climate two zones have to be taken into account, viz., that of the coastal region and that of the plateaux or highlands. The former is hot and moist, and in the neighbourhood of the rivers unhealthy. Malaria and intermittent fevers prevail during the hot season, i.e. from Novem-

ber to April. During this period the temperature at night is relatively very high. During the summer months the average minimum is $69^{\circ}8$ Fahr., the mean $74^{\circ}3$; the mean of the winter months is $66^{\circ}2$. The hottest months are January and February (mean 77° F.), the coldest, June and July (mean $61^{\circ}7$). The annual rainfall in the coastal region amounts to 67 inches. On the plateaux quite different climatic conditions reign. The air is pure and healthy, and Europeans can work there all the year round. During winter the thermometer sometimes falls to 23° or 24° Fahr.; but in two or three days it rises again. Snow seldom falls on the two plateaux next the sea, but on the third it falls almost every year. The mean temperature for the year on the plateaux lies between $62^{\circ}5$ and $64^{\circ}5$ Fahr.; that of the summer months never exceeds $69^{\circ}8$; and that of the winter seldom sinks below $53^{\circ}6$. In the year 1885 the rainfall, during 136 days at Curityba, the capital of the province, and situated on the first plateau, amounted to $68\frac{1}{2}$ inches. The province is well provided with roads; and a railway ($68\frac{1}{2}$ miles long) connects the capital with the seaport of Paranagua. Owing to the antiquated system of education in vogue, the results are not proportionate to the financial sacrifices incurred in the maintenance of the 189 primary and secondary schools, and the 116 subsidised private schools which exist in the province. The products of Parana embrace those of both temperate and tropical regions. The cereals principally cultivated are rye, barley, oats, wheat, beans, and maize. Potatoes, both European varieties and sweet potatoes, are successfully grown. Cotton thrives well on the coast flats, as well as in the northern portions of the highlands. Tobacco grows everywhere, and so does the vine; and rice on the coast lands. Promising hopes of future wealth are being built upon the cultivation of European fruits, in the feeding of silk-worms, and in bee-keeping. Moreover, on the lowlands of the coast, and in the valleys of the larger rivers up to the elevation of 1800 feet, coffee and the sugar-cane grow and prosper, as well as eight species of bananas, four varieties of oranges and lemons, together with numerous other indigenous fruits. As regards timber, Parana is one of the richest provinces in the Brazilian empire, more than eighty species of trees being found in its forests, amongst them the pinheiro (*Araucaria brasiliensis*) and the yerba maté (*Ilex paraguayensis*). The leaves and stalks of this last, which occurs in immense quantities from 2300 feet upwards, yield the well-known Paraguay tea, the preparation of which is one of the principal industries of the province. The remaining industrial establishments include flour-mills, sugar factories, brandy stills, wine-presses, breweries, a preserved-meat factory, candle and soap manufactories, tanning yards, wagon-works, etc. The province seems to be rich also in minerals. Iron is plentiful, especially magnetic iron and hæmatite, along nearly all the more important streams. Copper ore exists on the third plateau. Sulphuret of lead and quicksilver are found in a few places. Nearly all the rivers of the interior are auriferous, especially the Tibagy, in which diamonds also have been discovered. Several kinds of precious stones, particularly the agate, carnelian, amethyst, onyx, and jasper, occur in the province. A few thin seams of coal are known to exist.—*Deutsche Kolonialzeitung*, Heft 13, 1887.

Paraguay.—According to investigations carried out by the Statistical Department and the Minister of the Interior of this State, it appears that the population of Paraguay, exclusive of Indians, consists (1887) of 231,878 persons, of whom 94,868 are males, and 137,010 females. Of the foreigners resident in the country the Argentinians head the list with 4895; then follow 825 Italians, 530 Brazilians, 478 Germans, 228 Frenchmen, and 130 Swiss.—Herr B. Förster, in *Deutsche Kolonialzeitung*, 15th June 1887.

Tierra del Fuego.—Owing doubtless to the dreary and often stormy aspect of these regions, and the rocky and inhospitable nature of the coasts, there prevails, pretty generally, the popular opinion that the islands which constitute the group are so barren and bleak, and are characterised by such extremely inclement climatic conditions, as to be almost uninhabitable. But of late years, thanks to the enterprise and spirit of certain South American and Italian explorers, a truer conception of the real facts has begun to spread amongst scientific geographers. We have already, in these pages, referred to the labours of *M. Ramon Lista* in the island of Tierra del Fuego, properly so called. He has presented his report to the Admiralty Minister of the Argentine Republic, and in it he says:—Eastern Tierra del Fuego is traversed by two ranges of mountains—the Cordillera de los Nodales, from north-west to south-east, and Beagle Mountains, alongside Beagle Channel. In the former Mount Mitre rises to 1800 feet, and Cerro de Victor Hugo to 2000 feet. The most important river is the Pellegrini, which reaches the Atlantic some miles from Cape Peñas. Its breadth varies from 65 to 110 yards; its average depth is $6\frac{1}{2}$ feet; its current, in December, flows at the rate of $3\frac{1}{2}$ miles an hour. Its waters are clear, and have a temperature but little lower than that of the atmosphere. And whilst its banks are muddy and marshy, its bed is full of water-worn pebbles of various sizes, and contains some islets, and its valley is broad and rich in herbage. The remaining rivers are the Rio de los Tolues, from 22 to 28 yards wide, with a stony bed; the Rio Doce de Diciembre (Twelfth of December), which pours its unimportant current into the Atlantic a little more than two miles north-west of Cape Santa Inés; and the Rio San Pablo, which, after flowing between low-walled ravines (*barrancas*), reaches the ocean one mile south-south-east of Cape San Pablo. Meteorological observations have been carried on for some years at Ughuaia by Rev. Mr. Bridges. Near Cape Hornos the thermometer never fell below $17^{\circ}6$ Fahr.; at Santa Cruz, during the winter of 1886, it descended as low as $6^{\circ}8$; and at Chubut, further north, readings of $15^{\circ}8$ have been registered. The mean temperature of spring in the extreme south-west is not less than $53^{\circ}6$; in the Bay of Tethys, during the first fortnight of January, the temperature was $55^{\circ}4$. From Cape Espiritu Santo to the Rio Pellegrini prairies predominate; in the south, the region of Antarctic forests, the valleys and open country are covered with pasturage. Here grow calceolarias, umbelliferous plants, and trailing myrtles. In the oak woods, a profusion of gay-coloured flowers flourish—magnolias, fuchsias, barberries, *Codonorchis*, plantains, ferns, violets, lichens, and lilies of the valley. In respect of fauna, there are multitudes of birds (parrots, thrushes, humming-birds, bustards, ducks, penguins, cormorants, sea-swallows), several rodents, and insects. The waters of the ocean and Beagle Channel swarm with sea-wolves, fish, molluscs, edible crustaceans, zoophytes, echinoderms, polypi, and *Infusoria*. Veins of copper and lignite have been observed. The inhabitants consist of three races—the Yaganis, Alacalufs, and the Onas. Of these the first two differ greatly from the last, who have much affinity with the Tehuelches of Patagonia, and in stature stand fully six feet.—*Bull. Soc. de Géogr. Comm. de Paris*, tome ix., No. 6.

AUSTRALASIA AND POLYNESIA.

Recent New Guinea Exploration.—It has for some time been thought that the Aird River might give access to a region having more resemblance to the mountainous country eastwards than to the vast system of half-drowned plains, drained by the Fly and other similar large streams, further west. An expedition organised

by Mr. Theodore Bevan, F.R.G.S., has just returned from a short but successful exploration in that direction. It is a pity that an expedition so well equipped, comprising naturalists, miners, and photographic surveyors, should have been limited to a six weeks' excursion. The Aird proves to be only one mouth of a great river, which has been named the "Douglas," after the present capable and courteous Administrator of New Guinea. The party steamed up the Douglas for 130 miles to a point 80 miles inland in a direct line north from Cape Blackwood, returning by a channel, marked as dry land on the Admiralty chart, into Deception Bay. The main stream really commences 30 miles from the mouth of the Aird, where the deltaic flats cease, and there is rising ground on either side. Even in the lower part, however, the river banks are well defined. Above, the country consists of forest land, covered, in parts, only by palm-scrub, which could be easily cleared, and which is "practically uninhabited."

To the west of Orokolo six great openings were observed, and discovered to be the outlets of another large river, which was named the Jubilee, and which was ascended for 110 miles, or 5° of latitude from Bald Head, the general direction of its course being SW. This river, which, roughly speaking, is separated from the other by a degree of longitude, also gives access to a beautiful country, consisting of forest-clad hills, with a lofty range in the distance. The few natives met with—seven small tribes in all—were, with one exception, friendly and disposed to trade. Bananas and tobacco are, as usual, stated to be "indigenous." The party seems to have made an ethnological collection of some value, and we shall look forward with interest to Mr. Bevan's detailed report.

The sum of £1000 having been handed by the Victorian Government to the Melbourne Branch of the Royal Geographical Society of Australasia for purposes of exploration, the Society has decided on sending an expedition under Mr. W. R. Cuthbertson to make another attempt in the direction of the Owen Stanley range.

Island of Rapa.—The little island called Rapa or Oparo, which was discovered by the English navigator, Vancouver, in 1791, lies about 740 miles SE. of Tahiti, in the Eastern Pacific. Rising above the waters of the ocean like a vast extinct crater, its rim is broken and seamed by the sea, whilst its interior has been gradually filled up by the coral animalculæ. Atmospheric forces have also chiselled and heaped up huge piles of *débris* at their feet; and the surge, too, has wrought sad havoc in undermining them; so that the little island presents a strangely irregular and fantastic appearance to the eye. Nevertheless, in spite of all these destructive processes, during the past few centuries, its level has apparently risen; probably the real cause is the recession of the sea. Measuring about $4\frac{1}{2}$ miles by 3, and having an area of a little more than 16 square miles, the island, seen from its culminating point, Mt. Peharu, is indented on the north-east side by a broad and deep bay, fenced on both sides by steep escarpments; from these rocky walls the coast trends away towards the south and west. Along the east of Rapa runs a chain of four small islands. The interior of the island, the ancient crater, is entered by a passage (*Ahurei*), from a mile to a mile and a quarter long, from 110 to 160 yards wide, and ranging in depth from 150 feet in the middle to 80 at the sides. In shape the bay of Ahurei resembles a wide-open V, the arms pointing, one to the ENE, the other to the NW.; its breadth is about half a mile, and its length or depth of penetration inland about two miles. In spite of its exposure to all winds, the island enjoys a salubrious climate. From October to April an east wind prevails; whilst

during the rest of the year frequent westerly squalls are common. The thermometer has been observed to range in one year between a maximum of 75° Fahr. to a minimum of 59°. Rapa derives what importance it possesses from two facts: (1) It lies on the direct way between Panama and New Zealand; and (2) it has a coal mine, and gives promise that others may be discovered. The cultivated soil, which in extent does not exceed 5670 acres, is of great fertility. European vegetables, potatoes, and barley have been tried with good results, and so has the vine; but the sugar-cane grows with difficulty. The commonest plants are ginger, the Tahitian *ti* (*Dracæna terminalis*), roses, and ferns, amongst these last an arborescent species. The natives cultivate largely the taro (*Arum esculentum*). All kinds of tropical trees, except the bread-fruit tree, grow on the island, though, owing to the winds, they cannot be said to thrive well. The fauna includes goats, pigs, poultry, and sea-birds. The inhabitants, who speak a guttural dialect of old Tahitian, the same as is spoken by the natives of Rapa Vui (Easter Island), and the archipelagoes of Tubuai and Cook, belong to the Maori race. At the present time they probably number about 300. They are all followers of the Protestant religion, and can all read and write.—*M. X. Cailhet*, in *Bull. Soc. de Géogr. Comm. de Paris*, tome ix., No. 3.

ARCTIC REGIONS.

Spitzbergen.—We all know with what courage and enthusiasm scientific workers will encounter dangers and hardships for the sake of advancing the science they love. Perhaps no better illustration of the spirit in which these devoted men work could be found than in an account of a voyage to Spitzbergen and the Polar regions, by Herr Dr. Kückenthal, in *Verhandlungen d. Gesellsch., f. Erdkunde zu Berlin* (Bd. xiv., Nos. 5 and 6). Embarking on board a small one-masted whaler, which set sail from Tromsø in Norway, in the end of April 1886, Dr. Kückenthal did not reach Spitzbergen until 23d June. On that day they at length succeeded in breaking through the barrier of ice into Ise Sound, the largest and most northerly of the fjords of the west coast. Here, although the sound was nearly covered with ice, the enthusiastic zoologist was able to accomplish much good work, dredging specimens from the bottom of the bay. In the end of June the snow begins to melt in the lowlands and valleys; and then mosses, grasses, and flowers spring up as if by magic. In August again, the temperature, which rises during the short summer to between 38° and 41° Fahr., begins gradually to decrease, and, before the month is out, the first snow of the long, long winter has fallen. The interior of the island on which the hunters landed is described as being an inaccessible waste of ice, 1000 to 1500 feet high, the only variation being certain sharp projecting points of dark-coloured rock. The conformation of the coasts is such that their geological structure can, in many places, be studied with comparative ease. The island consists of a series of terraces, rising one above another, and having steep escarpments. The same geological formation—table-like forms with steep walls—prevails beneath the surface of the sea; at all events, inside the 220-fathom line. The east coasts of the archipelago are almost entirely unknown, owing to the absence of currents, so that the ice becomes packed up along those shores and remains almost immovable. For the movements of the icebergs and of the masses of pack-ice in these regions are determined mainly by winds and currents. Whilst waiting for the appearance of whales, a boat expedition was sent out for the exploration of the side arms and bays of the fjord; this party Dr. Kückenthal joined. In one of these bays, called Sassen Bay, exists the Temple Hill,

one of the most remarkable hills in the world. "Picture to yourself a wall of rock, nearly two miles long, and rising sheer from the water to the height of 3000 to 4000 feet. This wall does not, however, consist of a single compact mass, but is constituted by a vast entanglement of pillars and columns, with arches and windows between them. These are arranged in groups, and rise one above another in three stories, as in a building, resembling very closely the temple structures of the East Indies. In the architecture of the hill a surprising regularity and symmetry are observable. The roof is formed by a flat snow-field, from every crevice of which hang blue icicles, that keep up a continual dropping of water into the depths below. Seen from a distance, the stone appears to be of an intensely yellow brown; but when the hill is approached, it is seen that it is built up of individual strips of yellow, brown, white, and black, alternating with each other. And it is only in close proximity to it, that its gigantic dimensions can be appreciated. Some of the columns, standing quite alone, tower upwards of some hundreds of feet in height, and look as if chiselled by a sculptor." Behind this hill lies a bay which, although two or three square miles in extent, is not figured on the maps. Rowing into Klaas Billen Bay, they made the discovery that the deeper end of the fjord divides into two arms, the extremity of each being terminated by immense glaciers. The ice constituting these glaciers consists, not of one continuous mass, but of a number of separate columns and pyramids, whose sides are of a deep blue colour. The maps of Nord Fjord were found to be altogether untrustworthy.

MISCELLANEOUS.

In the year 1886 the Population of Brussels amounted to 448,088 persons; fifty years ago, in 1836, it numbered 128,210.

Professor F. A. Ober has a sprightly and interesting paper on *Florida and the West Indies* in No. 3 *Bulletin of the American Geographical Society* (1886).

On 1st January 1886 the Population of Austria-Hungary was 41,056,206. Of these 23,050,000 belonged to Cisleithania, 16,670,115 to Hungary, and 1,336,091 to Bosnia-Herzegovina.

The *Revue Scientifique*, 18th June 1887, contains an interesting paper by M. G. Rolland on "La Colonisation Française au Sahara." One of the cuts shows the remarkable appearance of the Sidi Amran artesian well, bored in 1884, and yielding 6000 litres per minute.

During the course of the present summer, Colonel Bobyr, in conjunction with several surveyors and a naturalist, M. Makeroff, are to explore the mountains of Sayan, the sources of the Jenisei, Lake Kossogol, the sources of the Irkut, Oka, Birussa, and the regions adjoining these.

During the past twenty years the inhabitants of Berlin have nearly doubled in number, as the following figures will show:—in 1867 the population was 702,437; in 1875 it was 968,634; in 1880, 1,118,630; in 1885 (31st December), 1,316,382; in 1887 (30th April), 1,330,080.—*Le Mouvem. Géogr.*, 3d July 1887.

In the course of a paper on *Hawaii and its Volcanoes*, from the pen of Dr. E. Arning, in the *Verhandlungen* (Bd. xiv., No. 4) of the Berlin Geographical Society, the author, after giving a *résumé* of the principal facts connected with the physical geography of the island, proceeds to discuss the formation of the two most important volcanoes—Mauna Loa and Kilauea—both of which have been in violent eruption during the present decade.

NEW BOOKS.

The Geology of England and Wales. By HORACE B. WOODWARD, F.G.S., of the Geological Survey of England and Wales. 2d Edition, 8vo. pp. 670. London : George Philip and Son, 1887. Price 18s.

The present is a considerable improvement upon the first edition of this most useful compendium of English and Welsh Geology. Ten years having elapsed since the first appearance of the work, the author has found it necessary to make considerable additions, so that in large part the book has been practically re-written. To working geologists this new edition will be highly welcome. Mr. Woodward has been most indefatigable in his desire to present the various views of his fellow-workers impartially to the reader. The result, however, is sometimes rather confusing to the reader, who would rather that the author showed some decided leaning to one side or the other. Fortunately, however, the book deals rather with facts than the inferences to be drawn from these—it is, in short, a guide-book to the Stratified Rocks, which are described in the order of their succession, beginning with the Archæan. The lithological characters, leading fossils, and economic products of the various formations are given, and the localities in which these formations are typically developed receive special notice. Separate sections are also devoted to Eruptive and Metamorphic Rocks, to Mineral Veins and Metalliferous Deposits, and to Denudation and Scenery. The usefulness of the volume is greatly enhanced by abundant references to original sources of information, and by numerous illustrations, which are chiefly *sections*, showing the geological structure of various parts of the country. To students of the stony science who are anxious to work any particular formation, no better guide-book than this can be recommended. By reference to its pages they will find a short but clear and comprehensive account of each particular group of strata, with special descriptions of the localities where the rocks are typically developed. To engineers and others who are interested in the practical applications of geology, Mr. Woodward's book likewise commends itself, for he has given us a complete epitome of what is known as to the economic products of the Stratified Rocks. The book is not intended for "general readers," and, like most works of reference, is rather dry and forbidding. It did not come within the author's plan, however, to descant upon the general principles of the science, or to discuss interesting theoretical questions. His main object, as he tells us, has been to enumerate the principal geological facts of England and Wales. He has given us the dry bones of the subject, and we must congratulate him upon the successful completion of his self-imposed task. It is not likely that geologists generally will agree with him in his classification of certain groups of strata. But into this matter we need not enter here. In our opinion it would be better if there was less readiness to modify and alter the arrangements of strata referred to. Such readjustments are worse than useless; they add nothing to our knowledge, and are only stumbling-blocks to a student. Before attempting to re-cast the classification of our Sedimentary Strata, it would be wiser, we think, to wait until our knowledge of their equivalents elsewhere in Europe has become more matured. When we have learned more clearly what were the physical conditions that obtained over the whole European area at successive periods in the past, we shall be in a better position to deal with the classification of British strata. We ought to mention that a Geological Map of England and Wales accompanies Mr. Woodward's

volume. The map is printed in colours, and shows the classification of strata adopted by our author.

Sketch of the Forestry of West Africa, with particular reference to its Commercial Products. By Captain ALFRED MOLONEY, C.M.G., Governor of Lagos. Pp. 533. London : Sampson Low and Co. Price 10s. 6d.

The work commences with a brief description of the various possessions of the different European powers in West Africa, giving the area, population, and principal products of each settlement.

Chapters iii.-xiv. treat of the vegetable riches most important to the trade of Britain, and furnish statistical and commercial information regarding the following exported commodities, taking them in the order of their value :—Palm-oil ; rubber (*Landolphia* and *Ficus*) ; coffee (*Coffea liberica*) ; gums and resins (copal) ; dyewoods (cam and bar-wood) ; cotton ; cacao ; cinnamon ; indigo ; cola-nuts ; tobacco. Much useful information is given regarding the cultivation of the oil palm (*Elaeis guineensis*) and the manufacture of the oil ; and tables show the wonderful extent to which this industry has grown. The botanical names of the trees from which Gambia rubbers are obtained have not yet been identified, but the vernacular names are recorded. Chapters xvi. and xvii. relate to reforestation and denudation, and there is a table of timber exports from West Africa. Among the most valuable woods are African teak (*Oldfieldia africana*) and Gambia rosewood (*Pterocarpus erinaceus*). There is a long list of the economic plants of Western Africa, with references to botanical authorities, among whom Professor Oliver of Kew stands foremost. Much labour has been bestowed in collecting forestry statistics regarding the vegetable productions of countries where a vast deal has yet to be done. There is a full and useful index.

L'Exposition Forestière Internationale de 1884 à Edimbourg. By E. REUSS, Inspector of Forests. Pp. 162. Paris, 1886. Price 3s.

Professor Reuss, of the Forest School at Nancy, was deputed by the French Government to report on the International Forestry Exhibition held at Edinburgh in 1884, and he writes in a friendly tone of our enterprise, which he evidently scanned with minute attention. The report contains a great amount of matter interesting to foresters and agriculturists. It is, in some respects, the most methodical and detailed report yet published, treating of the different countries represented from a forester's point of view. It is divided into four chapters, with numerous appendices compiled with ability and care ; and there is an excellent index. The volume of Forestry Essays, published at Edinburgh in connection with the Exhibition, seems to have escaped the author's notice.

Through Cyprus. By AGNES SMITH. Illustrated, with Map. London : Hurst and Blackett, 1887. Price 15s.

This book contains nothing that is new to geography. It is a pleasant narrative by a cultured Scottish lady, who made some reputation by her *Glimpses of Greek Life and Scenery*. After a description of life in Cairo, Alexandria, and Beyrout, in which justice is done to the American Presbyterian missionaries, the writer tells us how she and her companion sailed from Beyrout to Larnaca, and thence made a tour of Cyprus from east to west, in tents, with Arab servants. The island, for a feudatory claim to which we pay the Sultan of Turkey £93,000 a year, is said to "yield to none of our other British possessions in

beauty, in fertility, or in importance." The Cypriots have received from us good roads, elementary education, and public security. Famagusta is the only place which justifies Lord Beaconsfield's design to make Cyprus a place of arms, the sea having elsewhere retired from the old harbours.

Matthaeus Merian. Skizze seines Lebens und ausführliche Beschreibung seiner Topographia Germaniæ nebst Verzeichniss der darin enthaltenen Kupferstiche. Eine kulturhistorische Studie von H. Eckardt. Basel: H. Georg's Verlag. 1887. Pp. 224.

The Merians are an old patrician family of Bâle. The old house in which Matthaeus Merian was born, on September 25, 1593, is still extant, not much changed from what it was when acquired by his grandfather about the middle of the century. His father placed him under Dietrich Meyer, the painter and engraver of Zurich; and by the time he was twenty years of age, he had attained considerable distinction in his art. At Nancy, at Paris, in Italy, and in the Netherlands he continued to labour and learn for many years. De Bry, the publisher at Frankfurt, was anxious to secure his services in the illustration of his great works—the *Collectiones Peregrinationum in Indiam Occidentalem* (1590-1630), etc. Merian was not to be tempted by his proposals; but what the father could not do, the daughter, Maria Magdalena de Bry, accomplished. The artist fell in love with her, and by his marriage in 1618 was retained for a time in the service of Germany; and, after a short residence in his native town, he returned, and permanently settled in Frankfurt, at that time the centre of the book trade. He died there in 1650. Merian's *Topographia Germaniæ* is the finest work of its kind; and, with all its inequalities and imperfections, an abiding monument of German art in the service of Geography. Those who wish to learn the details of the methods adopted by Merian (in days when the photographic camera was yet unthought of) to obtain views of the various towns throughout Europe, will find all they wish in Herr Eckardt's lucid and careful narrative.

Akarnanien, Ambrakia, Amphilochien, Leukas im Alterthum. Von EUGEN OBERHUMMER, Privatdocent an der Universität München. München: Theodor Ackermann, 1887. Pp. xvi. and 300. Two maps.

Most Englishmen are content to take their classical geography from Smith's Dictionary; and it is an emphatic testimony to the placid equanimity of their disposition that their demands for fresher information have never tempted the publishers of that deservedly standard work to issue a new and revised edition, or brought them the surprise of a rival enterprise. And yet since Dr. Smith and his coadjutors first summarised the mass of information previously accumulated by geographical and classical scholars, immense advance has been made in this department of inquiry—accepted identifications have been disproved, forgotten sites have been recovered, sites scarcely visited have been carefully explored, and so on. The district of which Dr. Oberhummer treats in his compact volume is not one in which any of the most brilliant of modern explorations has been carried on; but it teems with ancient names of cities and sites of which not a few have left clear record—the Doric colonies of Leukas (Leukadia), Anaktorion, Ambrakia, the battle-site of Actium, Argos, Heraklia, etc. To the physical geographer, the account of the connection of Leukas with the mainland will be one of the most interesting passages, though the main facts have been frequently brought together by previous writers, and have found their way into text-books and encyclopædias.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE COLORADO RIVER OF THE WEST.

By H. M. CADELL, B.Sc., F.R.S.E.

To trace back things to their first beginnings is at all times one of the most fascinating of mental pursuits. The historian diligently seeks to discover the origin of our present political and social systems, and the biologist is ever busy constructing long pedigrees for all the families of the organic world. A like fascination attaches to the study of the evolution of the land we live on, its history in the past, and the origin of its mountains, rivers, and geographical configuration. In this latter direction there is still a large and fruitful region to explore; but it is a region which may not be entered alone and unarmed, as it is beset on every side with difficulties, and is full of pitfalls into which the unwary may easily stumble. The geographer must here take for his companion the geologist, whose eye can pierce the solid rocks and, catlike, see what to others is veiled in deep darkness.

In the Old World, it is often an exceedingly hard task to trace out the geographies of the past, and to ascertain the laws by which the land has received its present forms and outlines. The data are too few—the countries which have been investigated are too complex in geological structure and too small in area, to permit of grand generalisations being easily arrived at. In America, however, there are vast regions where such difficulties are much less formidable, and of these the basin of the Colorado is a notable example. Its geological structure is of the simplest kind. The rocks lie in a series of great flat plateaux, uniformly upraised from the sea-bed in which they were formed, and they have, after long

ages of exposure, been eaten away and deeply dissected by streams and rivers, so that their anatomy can be studied with the greatest ease. There is probably no other part of the world so well fitted to impress on the mind the marvellous erosive power of running water. The Colorado, in flowing for ages over these tracts of horizontal strata, has excavated a series of gorges altogether unique in their depth and architectural magnificence. For hundreds of miles the river rushes along the bottom of a chasm thousands of feet deep, across a barren, rainless desert, shunned alike by the hunter, the miner, and the settler, and inhabited only by a few wandering tribes of Indians. The scenery of this region is wonderful beyond description. The rocks have generally brilliant red, yellow, or purple hues, and are carved by Nature's graving tools into endless varieties of architectural shapes and patterns.

The whole length of this "Great Walled River," from its sources amid the snow-clad peaks of the Rockies to its mouth in the Gulf of California, is 2000 miles, and its drainage system, which covers 255,049 square miles, is the second largest in the United States. The region has been thoroughly explored, and much advantage may result from the study of the valuable physical and geological data, and their bearing on more general problems of geographical evolution in other lands.

The basin is physically divisible into two portions. The upper part, to which we shall devote attention in the following pages, has a general height above sea-level of 4000 to 8000 feet. It is sharply separated from the lower region by a line of mural precipice, from whose brink the surface of the country suddenly drops from an elevation of 6000 feet to levels ranging between 1300 and 3000 feet above the sea. From the foot of this huge boundary-wall there stretches westwards and southwards along the lower reaches of the Colorado a vast and nameless desert, bristling with sharp rocks and terrible in its grim desolation.

GRAND CAÑON DISTRICT.—The plateau region east of this wild sierra country occupies the north-west corner of Arizona, and stretches northwards to the High Plateaux of Utah. It is known as the Grand Cañon District from the stupendous cañon or gorge of the Colorado which crosses it from east to west and divides it into two distinct areas. The length of the Grand Cañon District from NW. to SE. may be taken at about 180 miles, and its width from NE. to SW. at 125 miles. As there is no natural boundary on the south, the total area of the region may be placed anywhere between 13,000 and 16,000 square miles. The general character of the Grand Cañon District will best be understood by a glance at Figure 1, opposite plate. The Grand Cañon is the deepest and most magnificent of the series of gorges through which the Colorado rolls its waters. Its length from the great cliff at the Grand Wash to the mouth of the Little Colorado, measuring round all the windings, is about 220 miles, but the distance between these points is only 125 miles as the crow flies. Above the Little Colorado (Colorado Chiquito) the river has a

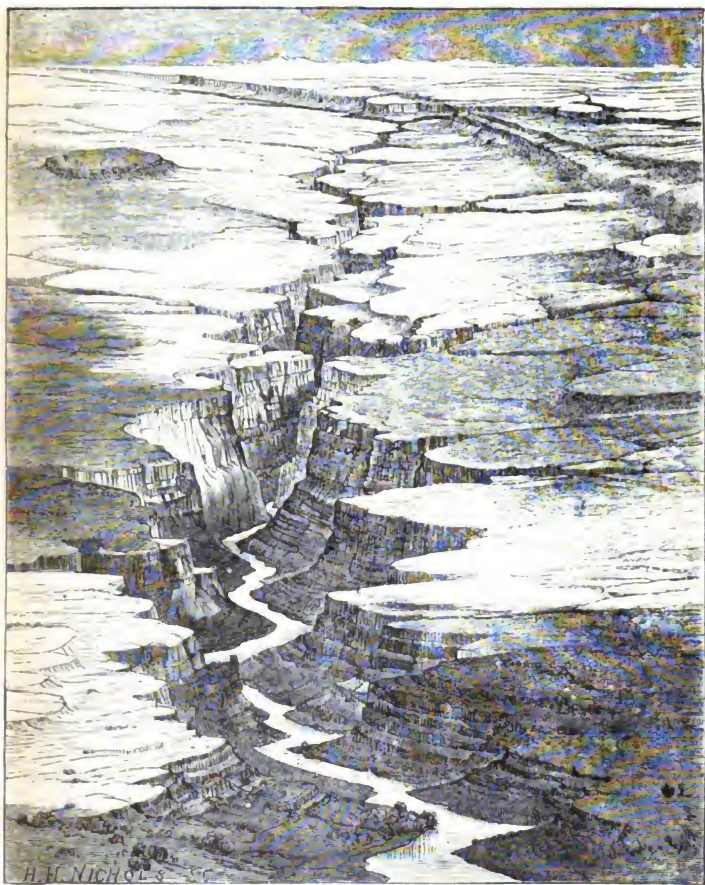


Figure 1.—View of Marble Cañon from the Vermilion Cliffs near the mouth of the Paria. In the distance, the Colorado River is seen to turn to the west, where its gorge divides the twin plateaus. On the right are seen the Eastern Kaibab Displacements, appearing as folds, and, farther in the distance, as faults, producing straight “cliffs of elevation.” The “cliffs of erosion,” near the brink of the Cañon, have all more or less indented sinuous outlines.

general south-westerly course. The part of the gorge between the Little Colorado and Paria tributaries is second only to the Grand Cañon in grandeur, and has been named by Powell the Marble Cañon, from the magnificent marble cliffs which form part of its walls. It is 66 miles in length, and ends at the foot of the Glen Cañon (Fig. 1).

The plateau region north of the Grand Cañon is drained by three principal streams. The most westerly is the Virgen River, which rises along the southern escarpment of the Markágunt Plateau, and flows south-westwards out of the plateaux, joining the Colorado in the desert, below the mouth of the Grand Cañon. The second drainage channel is the Kanab Creek, which flows due southwards from the plateaux, and enters the Grand Cañon by a magnificent side gorge in the middle of the Kanab division of the chasm. The third and most easterly tributary is the Paria River. It rises on the eastern side of the Paunságunt Plateau, and flows south-eastwards between the Paria and Kaiparowits Plateaux, entering the Colorado at the head of the Marble Cañon.

COLORADO PLATEAU.—The country draining into the Grand Cañon on the south has no marked physical divisions, but is a single nearly horizontal expanse 7000 to 7500 feet in altitude. It is known as the Colorado Plateau, and sweeps away southwards for fifty or sixty miles to the base of the volcanic range of the San Francisco Mountains. Low *mesas* gently rolling and clad with pine, piñon, and cedar, and shallow valleys yellow with sand or grey with sage, repeat themselves over the entire area. From such commanding points as afford an outlook over this region one solitary "butte" is always seen rising above the plain. Like Roraima, it is a pile of horizontal strata far removed from any rocks of the same family. Known as the Red Butte, it consists of Permian strata lying like a cameo on the flat Carboniferous beds of the plain, and owes its preservation to a hard cap of basalt poured out as lava when the region was entirely covered with Permian shales and sandstones. The erosion of ages has swept away all the surrounding unprotected beds of the same age, leaving this solitary outlier to tell its tale, as navvies leave pillars of soil in a cutting to show the amount of their excavation. An example of a solitary outlier of this kind is seen in the distance on the left side of Fig. 1.

The country north of the Grand Cañon is, unlike the Colorado Plateau, divisible into several distinct areas with well marked topographical boundaries. The Grand Cañon receives from this side the drainage of four plateaux—the Sheavwits, Uinkaret, Kanab, and Kaibab. East of these lies a fifth, the Paria Plateau, which drains into the Marble Cañon. Let us in imagination make a journey eastwards over this region.

SHEAVWITS PLATEAU.—This is the westmost of the four, and has for its western boundary the gigantic escarpment overlooking the Grand Wash, a broad and deep valley descending from the north, and entering

the Colorado at the mouth of the Grand Cañon. This strath is generally dry, but is occasionally flooded with deluges of mud during the winter rains. The plateau wall was produced by a great fault, on the east side of which the horizontal strata of the district were hoisted several thousand feet above those on the west. The displacement diminishes towards the north, and is not found forty miles north of the Colorado. The surface of the plateau, which is diversified by some volcanic masses and Permian outliers like the Red Butte, slopes gradually to the east and north-east for a distance of thirty miles, in correspondence with the inclination of the strata.

HURRICANE LEDGE.—The eastern limit of the Sheavwits Plateau is the Hurricane Ledge, one of the most striking topographical and geological features of the Grand Cañon district. It is a huge step, the result of a second fault, which, like the first, has lifted all the country to the east at a recent geological period. While the Grand Wash fault diminishes towards the north, the Hurricane fault continues to increase. At the Grand Cañon it has a displacement of 1800 feet. It runs straight north for thirty miles, and then begins to grow till it has displaced the region no less than 6000 feet at the place where it crosses the Virgen River. Above the Hurricane Ledge there are extensive grazing lands, and where there are springs the Mormon inhabitants have, by the help of irrigation, succeeded in raising the products of a temperate climate. In the region below, along the course of the Virgen and Santa Clara rivers, sub-tropical plants are cultivated, and for one standing on the ledge it is possible to throw a stone from the land of the potato and apple to that of the fig and sugar-cane.

The Hurricane Ledge presents an almost impassable barrier to the traveller across the plateaux. It may only be crossed where occasional narrow gullies have gashed its front, or where old volcanoes on the plateau above have poured over the brink streams of lava, and formed rugged slopes which may be climbed with difficulty.

UINKARET PLATEAU.—On gaining the top we reach the second terrace known as the Uinkaret Plateau. It is the narrowest of the four, but has strongly marked features. The Grand Cañon and Hurricane Ledge define it sharply on the south and west, while on the north the plateau terminates at the base of the Permian cliffs—the first step up to the High Plateaux of Utah. The eastern boundary is only partially supplied by the Toroweap Valley, which extends northwards from the Grand Cañon for some twenty-three miles, and then disappears, leaving no distinct dividing-line between this part of the Uinkaret and the Kanab Plateau on the east. The length of the Uinkaret Plateau may be roughly stated at 45 to 50 miles, and its width from 8 to 12 miles.

Like the Sheavwits Plateau, the Uinkaret has been the scene of repeated volcanic outbursts, and the billowy profiles and gloomy hues of

the basaltic cones and lava-flows, which cover a large area, form a sharp contrast to the rectilinear outlines and glowing tints of the surrounding region. The volcanic eruptions took place at two different times. The earlier series of eruptions was probably connected with the first throes of upheaval at the close of the Miocene period. After the successive and long-continued periods of uplift and denudation, during which the region received its present wondrous physiognomy, the volcanic fires again burst forth, and multitudes of little cinder cones and coulées of basaltic lava were formed on the plateau. The highest and most conspicuous part of the Uinkaret is Mount Trumbull, a broad, well defined, isolated mass, rising nearly 2000 feet above the plain at its base, and 3000 feet above the Toroweap Valley near its south-eastern flank. Two or three miles to the south-west lies Mount Logan, a tabular eminence of greater area but lower height than Mount Trumbull. Both these mountains are the denuded remains of the older volcanic series which were erupted when the surface of the region was still covered with Permian strata. From the top of Trumbull it is possible to make out over 120 distinct cinder cones of the later family, sprinkled like molehills over the plateau. Altogether some 170 such centres of eruption have been counted on the Uinkaret and its environs, the majority being thickly planted round the sides of Mount Trumbull. As a rule they are small, and rarely reach a height of 700 or 800 feet. The plateau is like the volcanic districts of Auvergne, or the Eifel and the Siebengebirge, where the extinct cones and craters have not yet been obliterated by the wasting hand of time, but impart to the whole landscape their characteristic type of scenery.

KANAB PLATEAU.—The Toroweap Valley runs along another line of fault, which, like those to the west, has lifted the region beyond, and given rise to a third great step upwards to the east. This line of cliff is 800 or 900 feet high at the foot of the Toroweap, but diminishes with the fault towards the north. The Kanab Plateau is the broadest of the four, but is the least pronounced in its features. It is a simple monotonous expanse of desert, with only one salient point of interest. This is the Kanab Cañon, a magnificent side gorge which runs through the centre of the plateau, and opens into the heart of the Grand Cañon.

KAIBAB PLATEAU.—We have now reached the highest and most interesting part of the Grand Cañon district. The Kaibab has an elevation of from 7500 to 9000 feet. The summit is comparatively flat, and terminates on the eastern and western sides in lofty battlements overlooking the barren wastes around. The plateau is an uplift between two great displacements throwing in opposite directions. These lines of dislocation converge towards the north and meet at the hamlet of Paria, thus giving the plateau a rudely triangular outline. The longest side of the plateau, extending from the Grand Cañon to the Vermilion Cliffs, is 90 miles in length. Its greatest breadth from east to west is 35 miles.

The surrounding region is a desolate expanse of flat crumbling rock, of a red or orange hue, unwatered save by scanty springs, and clad with nothing but sparse cactus or desert scrub. After toiling over this naked wilderness, and mounting the last great step, what a goal is reached in the oasis of the Kaibab! "Its broad surface is clothed with magnificent forest, opening in grassy parks, which during the summer are gay with flowers of rare beauty and luxuriance. It is a paradise to the explorer, who, weary of the desert, wanders with delight among its giant pines and spruces, and through its verdant but streamless valleys." The Kaibab is a moist region. In summer the rains are frequent, and in winter the snow lies deep, but there are no perennial streams such as are found in other mountainous regions of equal size and altitude. Every ravine is dry and carpeted with a turf of mountain grass, smooth as a lawn and richly bedecked with flowers. The trees, which are large and noble, stand well apart, except in the upper parts of the plateau, where the spruces predominate. The main genera are the yellow pine (*Pinus ponderosa*), the spruce (*Abies grandis* and *A. Engelmanni*), and the aspen (*Populus tremuloides*); but on the borders of the plateau, the cedar (*Juniperus occidentalis*), the mountain mahogany (*Cercocarpus ledifolius*), and the piñon (*Pinus edulis*) are also to be found.

In the centre of the Kaibab there is a small strath 10 miles long and about three in breadth, named the De Motte Park. It is smooth and treeless, but the ground surrounding it and rising rapidly to heights of 300 and 400 feet above its floor, is densely clad with forest. If the traveller loses his way among the hills, ravines, and forest glades of the Kaibab, which are all extremely like one another, he must go at once to the De Motte Park. The way may be long, but it is easy and sure. The main ravines all radiate from the summit overlooking the Park, and to find the way out of the labyrinth he has only to follow the course of one of them up to its head, and avoid deviating into any of the minor tributary branches. Pools of water are to be found at many parts of the Kaibab. They vary in depth from a yard or two to 100 feet, and have sometimes a diameter of over 100 yards. None of these are fed by running water, and their origin is somewhat obscure. The rains sink through the rock as easily as through sand, and supply the perennial springs that gush forth from the sides of the Grand Cañon thousands of feet below, and it is possible that these lagoons are the mouths of swallow-holes connected with the subterranean channels, and kept open by the solution of the limestone of the plateau.

From the summit of the Kaibab magnificent views are to be had of the wondrous region below. The panorama from Point Sublime is described in glowing language in the eighth chapter of Captain Dutton's *Tertiary History of the Grand Cañon District*,¹ a volume from which much of the information in these pages is drawn; and Mr. Holmes has, with

¹ Washington, 1882.

skilful hand, given us a vivid pictorial representation of the stupendous scene in the atlas accompanying the monograph (Plates xv., xvi., xvii.).¹

PARIA PLATEAU.—The eastern side of the Kaibab is formed by a great monoclinical bend downwards of the strata. The surface sinks rapidly nearly 4000 feet between the edge of the Kaibab and the brink of the Marble Cañon, where the bedding of the rocks is again nearly flat. The Paria Plateau is the northern part of the area between the Kaibab and the Marble Cañon. It is bounded on the north by the Paria River, and terminates on the south in the eastern extension of the richly coloured and ornate escarpment of the Vermilion Cliffs.

THE TERRACES.—All the great physical features imprinted by the *subterranean* forces on the Grand Cañon District cross it in an approximately north and south direction. There is, however, another and equally distinct system of cliff lines at right angles to the first. These are cliffs of erosion, which have not been elevated into their present forms, but are the result of the long-continued action of *subaërial* agencies. As we go northwards from the brink of the Grand Cañon, parallel to the ledges that separate the minor plateaux, the land begins after a while to rise in a series of terraces which form a great stair up to the High Plateaux of Utah.

For many miles round the Grand Cañon the country consists of sandstones and limestone beds of Carboniferous age. They appear at first quite horizontal, but on closer inspection are seen to slope very slightly towards the north. This inclination is not uniform, but varies from *nil* up to 2° or 3°, and may be averaged at 40' over the whole plateau. Small as it appears, its cumulative effect is great enough to depress the surface of the Carboniferous formation to sea-level beneath the Markágunt Plateau, and to raise it to a height of 8000 feet at the San Francisco Mountains, 130 to 180 miles further south. Had the beds been quite flat we should, in ascending from the edge of the Grand Cañon to the top of the Terraces, have to climb 10,000 feet, as this is the thickness of the formations beneath which the Carboniferous series is buried. The slight tilt which the area has received, however, saves us half this climb, for, on crossing the edges of the Terraces, we only gain 5000 or 6000 feet in height.

The lowest terrace, known as the Shinárumpt Cliffs, is formed by the outcrop of the Permian sandy shales and sandstones, scattered outliers of which have been already mentioned as occurring sporadically over the plateau. The hues of the Terraces are gorgeous in the extreme, and

¹ A reduced copy of one of Mr. Holmes' best drawings of the scenery of the Grand Cañon forms the frontispiece of Dr. A. Geikie's *Text-Book of Geology*. Copies of this and other publications of the United States Surveys may be seen in the Library of the Scottish Geographical Society, and in those of other scientific Societies in the country. The accompanying illustrations are from Powell's *Report*.

reach their climax of brilliancy in the Lower Triassic and Permian series. Dense rich reddish-brown bands and streaks of chocolate are interbedded with purple, violet, lavender, and white, while lower down there are layers of a peculiar Indian red, alternating with more sober greys.

THE VERMILION CLIFFS.—The Permian terrace is not always distinct, and sometimes runs under and forms part of the great Triassic escarpment of the Vermilion Cliffs. This huge mural precipice runs eastwards from the Hurricane Ledge to Paria, and, crossing the Colorado at the foot of the Glen Cañon, trends southwards under the name of the Echo Cliffs, which gird in the Grand Cañon District on the east. The Vermilion Cliffs increase in size and magnificence towards the valley of the Virgen, where they rise 2000 feet above the plain. The sandstone beds, which greatly predominate, are separated at places by thin bands of gypseous shale, and these, being partly soluble, are more easily eaten out by the weather. They thus produce lines of deep shade which cross the cliff faces, and throw into stronger relief the bright-coloured sandstone zones between. The shales retain a wonderful uniformity over wide areas, and individual beds may be traced along the cliffs with unchanged thickness and hue for many miles. Near the top of the Trias is a massive bed of sandstone everywhere distinct from the thinner bands below. It swells in thickness from 200 feet at Kanab to 1200 feet in the valley of the Virgen. It is gashed from top to bottom with straight vertical joints, and the weather, taking advantage of all such weak places, is ever at work widening the joint fissures into deep gullies and clefts. After long ages of such erosion the summit of the Vermilion Cliffs has become fretted and carved into domes, towers, and pinnacles of wondrous form and beauty.

In the neighbourhood of the Virgen, the Vermilion Cliffs send off buttes resembling vast bergs detached from the parent ice-sheet, only here it is the parent mass which has retired, and the bergs which have withstood the powers of the air. Architecturally the buttes may be likened to colossal temples and cathedrals flanked with massive buttresses and crowned with domes and spires, which shoot high into the air and mingle with the clouds. They are carved and fretted into the most ornate and ever-changing forms, but are all built on the same plan, cut from the same block, and girded with the same bright belts of colour.

THE WHITE CLIFFS.—Each formation in the Grand Cañon region has its own style of architecture. When we reach the terrace above by one of the few passes through the Vermilion Cliffs, we are confronted by another line of precipices of a totally different character. The Jurassic series, which follows the Trias in palæontological succession, is here represented by bright red fossiliferous shales resting on a very massive bed of white sandstone, nearly 1000 feet in thickness. The shales are from 300 to 500 feet thick, and yield typical Jurassic fossils, but it is the great sandstone bed that first strikes the eye and draws the attention of the

explorer. The white cliff-faces are, on near inspection, seen to be etched with myriads of gracefully curved and diagonal lines of "false-bedding." The harder laminæ project in little ridges from 6 to 15 inches beyond the softer ones, and the entire surface comes to have the appearance of a huge piece of petrified filagree work. But in the distance all minor features fade away, and the cliffs rear their pallid battlements aloft, unmarred from base to summit by vertical or horizontal shadows. Unlike the ornate Vermilion Cliffs below, the Jurassic escarpment is as bald and severe as a row of military barracks. Their appearance is not even relieved by a fringe of sloping talus, like the long smooth bank that sweeps round the base of Salisbury Crags at Edinburgh, and adds so much to their impressiveness and massive strength. The White Cliffs are, however, not altogether devoid of scenic interest, as their edges are sinuous and often furrowed by gullies, or occasionally carved into dome-shaped buttes and stacks of fantastic form.

From the top of the White Cliffs the country slopes upwards to the Markágunt and Paunságunt Plateaux. The outcropping edges of the Cretaceous sandstones and shales do not here give rise to very prominent terraces; but in the Paria district the ledges rise quickly tier above tier, and form an imposing stairway 4000 feet in height. The Cretaceous rocks show none of the orange, purple, and chocolate hues so common to the other formations of the district, but the pale yellows and light brown tints of the sandstones, intercalated with the blue or dark iron-greys of the shales, give an altogether peculiar colour-effect to this formation.

THE PINK CLIFFS.—We have now reached the highest of the terraces. The Eocene escarpment of the Pink Cliffs crowns the Cretaceous slope, and completes the list of formations in this region. It is not a deep-sea formation, but is a series of deposits formed in a lake, brackish at first, but afterwards quite fresh. These beds bespeak a great change in the geological and physical history of this part of the earth's crust. They tell of upheaval of the land and disappearance of the sea over large areas, and the beginning of the present history of a great continent. The cliffs are carved into rows of square obelisks and pilasters of uniform size and pattern, and produce the effect of a huge colonnade from which the entablature has been removed or fallen in ruins. There are limestones at the top, and thick beds of marl below, mixed with sandstone and conglomeratic layers. At the top there is a snow-white band over an orange yellow zone, but the main mass of the cliffs has a pale red tint, which, as the sun sinks towards the horizon, deepens into a rich rose colour, seen in no other rocks, and beautiful beyond description.

THE GRAND CAÑON.—Such are the main orographic and structural features of the plateau region through which the Colorado has cut its gorge. The wonders of the great chasm itself may perhaps be best described by first giving a short account of Powell's memorable pioneering

voyage through the cañons in 1869.¹ Major J. W. Powell, his brother, and eight men formed the party who, on the 24th of May 1869, started in four stout boats from Green River City on the Union Pacific Railway. The voyage down the Green River was exciting and perilous in the extreme, and many hairbreadth escapes were made long before the Grand Cañon was reached. The boats were often overturned among the rapids, and one was dashed to pieces at the Disaster Falls, a very bad part of the gorge through the Uinta Mountains, where Ashley, a previous explorer, had been wrecked, and several of his men drowned. The adventures had occasionally a certain smack of grim humour about them. On one occasion Powell and one of his men began the ascent of the cañon wall just below the mouth of the Yampa, a tributary of the Green River above its junction with the Uinta. After ascending five or six hundred feet they came to a sheer precipice, up which they managed to climb till the top was nearly reached. "Here," says Powell, "by making a spring I gain a foothold in a little crevice, and grasp an angle of the rock overhead. I find I can get up no further, and cannot step back, for I dare not let go with my hand,² and cannot reach foothold below. I call to Bradley for help. He finds a way by which he can get to the top of the rock over my head, but cannot reach me. Then he looks around for some stick or limb of a tree, but finds none. Then he suggests that he had better help me with the barometer case; but I fear I cannot hold on to it. The moment is critical. Standing on my toes, my muscles begin to tremble. It is sixty or eighty feet to the foot of the precipice. If I lose my hold I shall fall to the bottom, and then perhaps roll over the bench, and tumble still further down the cliff. At this instant it occurs to Bradley to take off his drawers, which he does, and swings them down to me. I hug close to the rock, and let go with my hand, seize the dangling legs, and, with his assistance, I am enabled to gain the top."

On they sped, past the mouths of the Uinta and Grand, camping at the river's brink at night, and naming the precipices and the unknown cañons they sailed through by day. Higher and still higher towered the walls on either side, and when, on the 12th of August, the foot of the Marble Cañon was reached, they found themselves sailing in the bottom of a chasm three-quarters of a mile beneath the level of the surrounding country. The Great Unknown now lay before them, and no voyager had ever solved the problem of that awful gulf. "Stories were related of parties entering the gorge in boats, and being carried down with fearful velocity into whirlpools, where all were overwhelmed in the abyss of waters; others of underground passages for the great river, into which boats had passed never to be seen again. It was currently believed that

¹ For full information, see Professor J. W. Powell's *Report on the Exploration of the Colorado River of the West and its Tributaries*. Washington, 1875.

² Powell had gone through the Civil War, and had lost his right arm in the battle of Shiloh.

the river was lost under the rocks for several hundred miles. There were other accounts of great falls whose roaring music could be heard on the distant mountain summits. There were many stories current of parties wandering on the brink of the cañon, vainly endeavouring to reach the waters below, and perishing with thirst at last in sight of the river which was roaring its mockery into dying ears."

The gorge had increased in depth from 200 feet at the head of the Marble Cañon to 3500 feet at the beginning of the Grand Cañon. The path had always been found roughest where the rocks were hardest, but now the river entered a gorge of metamorphic rocks harder than any that had before been met with. A roar of waters was heard ahead where the river dashed over a set of falls with a descent of 75 or 80 feet in a third of a mile. Granite crags rose dark and grim on either side, and as no footing was to be had along the water's edge whereby a "portage" might have been effected, no alternative was left but to shoot the rapids, and brave the dangers of the river or perish in the attempt. Their skill and pluck were rewarded. The rapids were safely passed, and the three boats shot into smooth water below the falls. The bottom of the gorge was dark and narrow. Black granite walls rose 1000 feet above the river, and above the granite the flaring red carboniferous strata, with their characteristic ledges, scree, and corners, towered high into the air, and spread out over the surface of the plateau more than a mile above the river's brink. Other falls were reached, and the boats became unmanageable. One was overturned, and the crew thrown into the raging river. The water-tight compartments, with which she was fitted in bow and stern, kept her up, however, as they had often done before, and her occupants, clinging to the sides, were rescued by their comrades in the other boats.

The granite and metamorphic rocks cropped out only in the part of the cañon opposite the Kaibab Plateau, and when, on the 21st of August, the party crossed the line of the West Kaibab displacement, the dreaded crags disappeared, and they were swept into quiet waters. Since starting, they had passed more than 600 rapids and falls, and were now in a pitiful plight indeed. The little canvas they had for camping under at night was rotten and useless; the rubber ponchos had all been lost, and more than half of the explorers were without hats to ward off the sun's rays when the thermometer stood above 110°. They had not a blanket a piece, and, worst of all, rations were nearly exhausted, and could not last much more than a week. As the barometers were all so much injured as to be useless, the reckoning in altitude was lost, and it was impossible to know how much descent still lay before them.

At several parts of the cañon they were surprised to find ruins of stone and lime buildings, pieces of pottery, flint chips, and other relics of a race more civilised than the Indians who now inhabit the plains above. These may have been the homes of the aborigines who, tradition says, were driven by the Spanish invaders from Arizona and New Mexico, and sought safe retreats in the then unknown lands of the cañons.

Between the Kaibab and the Hurricane Ledge the walls of the cañon are of the soft Carboniferous strata of the plateau, and the rapids are consequently less numerous and steep than in those parts where granite predominates. On reaching the Uinkaret division of the gorge the remains of the old volcanoes were seen crowning the cañon walls. At some places floods of lava had been poured over the brink, and had once filled the chasm to a height of 1200 or 1500 feet. But the river had cleared out its course again, and was once more grinding down into the old sandstones and limestones below. On the 27th of August the boats reached the line of the Hurricane Ledge, and here fresh troubles began. The river turned southwards, and the dreaded granite hove once more in sight. The falls ahead roared louder than any that had yet been passed, and the stoutest hearts began to quail. One of the crew wrecked at the Disaster Falls had left the party at the Uinta River, and gone home, satisfied with the perils he had already encountered, and now three others refused to enter what seemed the very jaws of death, preferring to climb the cañon wall, brave the desert and the Indians, and find their way to the nearest Mormon settlement, seventy-five miles off. One of the boats was so battered that Powell, with his brother and their four remaining comrades, determined to leave her behind, and explore the rest of the cañon in the two others, or perish in the attempt. The three deserters helped their companions to lift the boats over a rock 25 or 30 feet high, and after a sad good-bye, began their ascent into the plateau above, and were soon lost to sight. The falls proved dangerous, but not so bad as they appeared from above. The boats were dashed about, and Powell's was upset, but no lives were lost, and on the evening of the 28th of August they left the granite behind, and breathed freely once more. Next day they passed the Grand Wash, and, with feelings better imagined than described, emerged from the portals of the Grand Cañon.

Inquiries were made about the three men who left above the granite falls, and their sad story was soon learned. The poor fellows arrived almost starved at an Indian village, and were kindly treated and put on their homeward way. They were, however, afterwards followed up and murdered by the Indians, who mistook them for a party of miners who had lately killed a squaw, and would not believe their story of a voyage down the dreadful cañon.¹

DIMENSIONS AND FORM OF THE GRAND CAÑON.—The distance from the Little Colorado to the Grand Wash is $217\frac{1}{2}$ miles following the

¹ In the *Bulletin* of the American Geographical Society, June 30, 1887, an article, entitled "The Great Walled River," gives an account of a second and better equipped expedition, under Powell, down the Colorado in 1871 and 1872. None of his original comrades accompanied him again. With three boats and ten men he sailed down as far as Kanab Cañon, where the height of the water, and the news of an ambuscade of Indians further down the river, led him to discontinue the voyage.

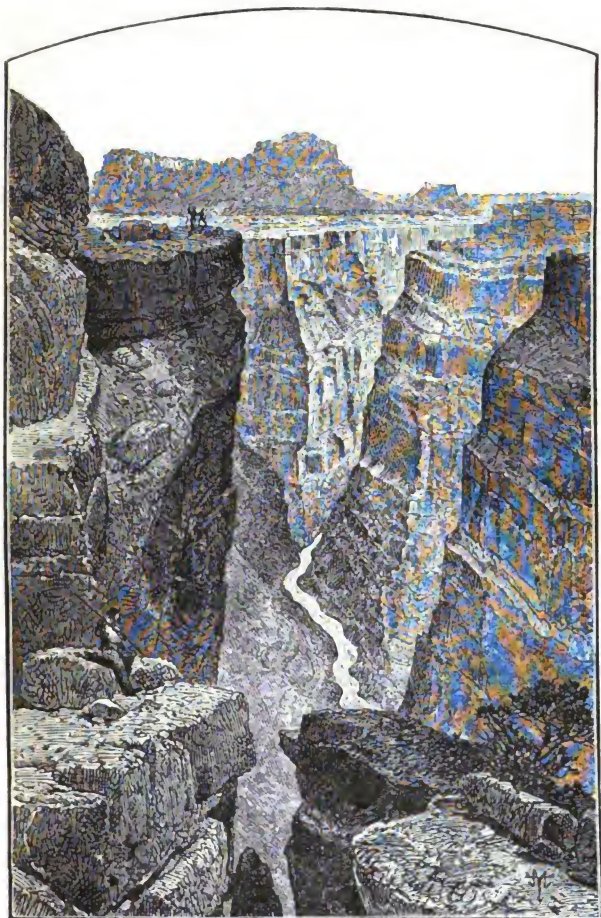


Figure 2.—View of the inner gorge of the Grand Cañon of the Colorado, looking east from Toroweap.

windings of the river. At the confluence of the two Colorados the Grand Cañon has a depth of 3600 feet. Three or four miles west of this point the land rises quickly to the summit of the Kaibab, and the gorge deepens in consequence to about 6000 feet. The Kaibab division—about 60 miles in length—is the most sublime part of the Grand Cañon. It is 1000 feet deeper, more diversified, and better adorned with magnificent features than any other portion of the chasm. The side walls are suddenly lowered by each of the great faults which cross the plateau, but the declivity of the river-bed soon repairs the lost altitude. At the Grand Wash the river issues from a gateway 5000 feet in height, and the walls on either side sink to mere banks a few hundred feet above the water's edge.

The absolute height of the river-bed falls from 2640 feet at the Little Colorado to 1000 feet at the Grand Wash, so that the average slope of the bottom of the Grand Cañon is 7.56 feet per mile. This inclination is far from uniform, as Powell found to his cost, and varies from 12.07 feet among the hard granite crags beneath the Kaibab to 5.01 in the softer sedimentary division of the Kanab. In the Marble Cañon the average fall is 7.82 feet per mile, and the whole fall, from the head of the Marble Cañon to the foot of the Grand, is 2190 feet for a distance of $283\frac{1}{2}$ miles. The total fall between Green River Station and the Grand Wash is 5000 feet.

The Grand Cañon is not a simple chasm like a great crack with straight sides, but is divided into two distinct parts. There is first an outer valley, from 5 to 6 miles broad, between vertical walls of cliff 2000 feet in height. This great esplanade is rough indeed, but relatively flat when compared with its lofty walls. The inner or second part of the cañon runs like a trench along the middle of this floor. It is 3000 feet deep, and from 3500 to 4000 feet in breadth, measuring from brink to brink between the nearly perpendicular walls. Fig. 2 conveys an idea of the appearance of the inner cañon opposite the Kanab Plateau.

GEOLOGY OF THE GRAND CAÑON.—The walls of the outer cañon are of limestone and brilliant red sandstone. They constitute the Aubrey division of the Carboniferous formation of this region, and, although innocent of coal seams, are believed to be the equivalents in age of the coal measures of Pennsylvania and Britain. The strata of the inner gorge are known as the Red Wall group, and consist of red and brown sandstones and massive beds of purplish limestone. These strata rest unconformably on the upturned edges of an enormous mass of older stratified rocks, which form the lower part of the cañon wall for some miles below the mouth of the Little Colorado. The latter are conspicuous in the distance by their regular bedding and chocolate and magenta tints. They are believed from fossil evidence to be of Silurian age. There is, however, a still older group of rocks on which the Silurian beds in turn repose unconformably. In cutting through the granite the river has dissected the region to the bone, and exposed the whole anatomy of the

plateau. The Archæan crystalline schists, which may be popularly described as granite, are the primeval foundation on which the stratified formations have been reared. They formed the framework and superstructure of the land in the dim mists of geological antiquity. Volcanoes burst through and poured their floods of lava over that ancient land-surface, and some of the lavas may still be seen in section high up in the cañon wall. Worn down and afterwards submerged, the Archæan rocks became buried beneath many thousands of feet of sediment in the seas of Siluria. The sea-bed was in course of time again upheaved, and the deposits were crumpled from below and attacked by the watery elements above. The Silurian fragment in the Grand Cañon is part of a formation 10,000 feet in thickness, the greater part of which has been completely denuded away. A long-continued submergence now set in. While coal forests grew rank and dense on the neighbouring land, a constant shower of sediment was rained on this part of the ocean floor. Deposition went on throughout the Secondary ages, and was not arrested till the final upheaval began at the beginning of the Tertiary Period.

At the close of the Cretaceous Period the region south of the Uintas was cut off from the sea and converted into a great fresh-water lake, in which Eocene strata were laid down. This movement of upheaval affected the entire western part of the continent. Several lakes were formed; but the Plateau Lake was the largest, and sediment accumulated in it to a thickness of from 1200 to over 5000 feet. In course of time it began to dry up, and shrank slowly away from the south, finally disappearing at what is now the base of the Uintas, at the close of Eocene time.

THE LIFE-HISTORY OF A RIVER.—Rivers are born with the land, and their first courses are shaped by the prevailing slopes. While the land remains above sea-level its drainage areas are being constantly worn away, and this process will only be arrested when the rivers reach their "base-level of erosion"—the slope at which their transporting power ceases, and they begin to deposit their load. Most of the British rivers have reached this stage in their history, and meander along nearly level straths with velocity scarcely sufficient to carry seaward aught but the finest sediment. They cannot therefore deepen their beds any further: all they can do is to widen the straths, and spread abroad the alluvium from their swift mountain tributaries. In such a climate as ours the valleys all come to have a shape like a roofing tile, because the rain and frost eat back the sides of the channel as fast as the river scoops its way downwards. Were the climate dry, atmospheric erosion would be less active. The river would work by undermining, and the cliffs would consequently be kept vertical like those below the Falls of Niagara. With a high inclination the river would rush on at a correspondingly high velocity, and erode very actively. It would work downwards and produce a gorge, until the base-level was reached, and then it would have leisure to cut into the cliffs, and widen its channel into a strath.

EFFECT OF A DRY CLIMATE.—Such are the conditions under which the Colorado is at work. It is fed by the melting snows of the Rocky Mountains, and flows for many hundreds of miles through a dry region, where scarcely any addition is made to its volume. Between the junction of the Grand and Green and the lower end of the Grand Cañon—a distance of 500 miles—the Colorado has only two tributaries of importance. These are the San Juan and the Little Colorado. Professor A. H. Thompson gauged the Grand and Green in 1877, and found the minimum flow of the Colorado at the confluence to be 9260 cubic feet per second. The greater part of the water that the river receives from its tributaries, and from the springs which issue from the bottom of the cañon walls, is probably needed to compensate for the loss by evaporation. The dryness is extreme and the heat intense in the plateau region. From June to September the midday temperature is seldom below 90°, and often exceeds 110° F.; while the relative humidity is from 0·3 to 0·4 of saturation. The excessive aridity and heat sometimes give rise to the curious meteorological phenomenon of rain-streaks—showers which fall a certain distance, but are evaporated in mid-air before reaching the earth. The average rainfall is unknown, but Dutton thinks that 4 inches per annum is probably as large a precipitation as we are at present justified in assuming for the district draining laterally into the Marble and Glen Cañons.

In such an arid region atmospheric erosion is very small. The cliffs of the plateaux retain the vertical profiles they received when sawn into by running water during a moister age. The sharpness of the cliffs and the remarkable absence of tributary streams are the two most striking evidences of a long-continued rainless climate. The latter feature is very conspicuous in the valley of the Nile, which, in this respect, is the Old-World counterpart of the Colorado. The sources of the Nile are in far-off moist regions. It receives little or no water on its way, and but for the fact that it has nearly reached its base-level of erosion, the lower Nile Valley would be a typical cliff-walled cañon.

EROSIVE POWER OF RIVERS.—The lapidary's wheel is powerless to cut hard gems without a coating of still harder diamond dust strewn on it; and in like manner a river is powerless to erode its channel without a load of hard sediment to cut with. The sandblast is a powerful grinder, and can achieve great things when continuously and well directed. In the hydraulic mines of California, the water discharged against the gravel banks has been known to cut in a single year (equal to 100 days of uninterrupted work) channels from 10 to 20 feet deep in the hard basaltic pavement over which it flows. The course of the Colorado is steep and its flow is rapid. It receives large quantities of sand and gravel from its tributaries, and from the cliffs and gullies at its sides. The rocks crumble gradually down as the calcareous or gypseous matter which holds the particles together is dissolved away. When rain falls,

the loose disintegrated materials are washed down the long screes and side gullies, and are poured in torrents of thick mud into the central chasm. During such spasmodic floods the water often carries along more than twice its volume of solid matter. It is a common experience of explorers, in filling a camp-kettle from one of these burns during a spate, to find, after letting it stand all night, an inch of doubtful water on the top, over 7 or 8 inches of viscous red clay and 3 or 4 of sand and grit at the bottom. These mud torrents are not confined to the winter months, as local showers fall during summer with considerable frequency. The blocks which fall from the cliffs are soon ground up and carried off in particles by the river. Dutton estimates that, when exposed to the full force of the current, the largest masses can scarcely last more than three or four years. At the mouth of each lateral gorge a cone of alluvium is shot into the Colorado, and forms a barrier over which the water dashes in short and violent rapids. The rapids due to the unequal hardness of the rocky channel are long, and, with some notable exceptions, less violent than those over the piles of alluvial boulders.

THE HISTORY OF THE COLORADO AND ITS LESSONS.—The history of the Colorado, from its first beginnings in the far-off Miocene Period to its wonderful achievements in our own day, has been deciphered with great skill by the experienced officers of the United States Geological Survey. The sumptuous monographs descriptive of the regions explored are a mine of wealth to the geographers and geologists of the Old World. A careful study of these works will amply repay the trouble, and will throw much light on problems which, in the more complicated lands of the Old World, are dark and difficult to understand. Had the cradle of Geology been in the Far West, the science would doubtless have grown stronger and reached a riper manhood than it has yet attained. The history of the rocks is there so simple that a child could read, and rival theories with their accompanying *odium geologicum* are out of the question. But great discoveries are only received when the spirit of the age is ready to accept them, and Hero of Alexandria lay for nineteen centuries in his grave before any practical use was made of his invention—the steam-engine. It is only lately that we have reached the stage when the wonders of the West can be rightly appreciated, and men and money found to thoroughly explore and explain its vast unpeopled tracts. The story of the Cañons would not have been believed 100 years ago when Geology had its first beginnings; and there are still some geological sceptics who scoff at the denudation theory, and ascribe the cañons to convulsions of mother earth, supposing them to be great cracks in the crust, like those produced by the sun on the mud of a dry pond. Let us lay aside prejudice, and, looking the facts straight in the face, decide impartially which explanation is the true one.

We must return from the digression we have made, and again resume the thread of the geological history of the plateau region, which was left off

at the close of the Eocene Period. The great fresh-water lakes gradually dried up, and the denudation of the surrounding region went on apace. Let us imagine what would take place if the whole region of the Canadian Lakes were to be progressively upheaved several thousand feet. The declivity of the St. Lawrence would increase, and it would scoop out its bed at a correspondingly quicker rate. In course of time it would so deepen its channel that it would drain in succession Ontario, Erie, Huron, and Superior, and become a great river with many branches spreading over the beds of the dried-up lakes. The sediment in the lake bottoms would in time be washed or worn away, and the river would work its way downwards through the underlying rock, till it reached its base-level of erosion. It would then work laterally like a scythe, and broaden its gorge into a strath, till the whole drainage area became reduced to a comparatively level plain. Between the main groups of tributaries, patches of high ground, with perhaps some of the old lake deposits still lying on them, might be left remaining as plateaux, from whose nature the existence of former lakes could be ascertained. Such seems to be the general sequence of events in the history of the Colorado: first, great lakes; then, a St. Lawrence; and lastly, a great river rising in the interior of a continent, and flowing in a deep gorge of its own making, through straths excavated at a former stage in its history.

It is usual to suppose mountains to be the most permanent of the landmarks of the globe. But this is not always the case, as rivers may, under certain conditions, retain their positions even more permanently for long geological periods. This is a most striking and important feature in the history of the Colorado. Fill up all the gorges and restore the breached barriers, and the melted snows of the Rockies will not seek to clear the old channels out again, but will find their way seawards by quite a different route. The upper reaches of the Colorado are especially instructive in this respect. The Uinta Mountains in Utah branch off from the Wasatch range in an easterly direction, and extend right across the course of the Green River. Towards the east the Uintas diminish in height, and become lost in a series of low ridges and hills. The river does not, as might perhaps be expected, bend to the left and make a circuit round the eastern end of the barrier. Instead of this, it runs right through the ridge at the bottom of a cañon nearly 3000 feet deep, and emerges on the south, to be joined by the White River and the Uinta in a comparatively level country. Very little examination is needed to dissipate any idea that the cañon through the Uintas is a crack rent open by convulsions of the crust, and afterwards taken advantage of by the river in its southward course. The true explanation is, that the river was first on the ground, and had the prescriptive right of way. In a sawmill, it is the log and not the cutting edge that moves forward; so here the river has remained stationary, while the land has been pushed slowly up against its cutting edge, and grooved with a gigantic saw-draught equal in depth to the amount of lift. The ridge of the Uintas rises to a height

of 3000 feet above the river, but this distance by no means represents the whole amount of cutting the river has performed. While it has been at work deepening its channel, the atmospheric forces have been wearing down the country on either side. The Uintas rose as a huge wrinkle on this part of the earth's crust, and could the crown of the arch be restored by building up the lost pieces, it would rise to a height of 24,000 feet above its abutments. We must not suppose it ever actually reached this altitude, as the wearing down probably kept pace with the upheaval. There has been a race on the downward path between the river-bed and the surface of the country; and the river, by concentrating its energies along one line, has won by 3000 feet. The total length of the racecourse was 24,000 feet, so that the present cañons through the Uintas only represent an eighth of the whole cutting the river has made since the great wrinkle rose athwart its path.

The same process of upheaval has gone on along the lower reaches of the river; and the fact that it has not altered its course shows how very slowly such movements of elevation take place.

During the moist Miocene Age, the plateau region was rapidly eaten away. The river, which carried off the Eocene lake deposits and the Secondary formations south of the terraces, at last reached its base-level of erosion. The Carboniferous rocks were probably protected by being below sea-level, and the river, after removing the Secondary strata, could not do more than partially smooth down the Permian beds which lay below. A time of elevation now began, and volcanic action accompanied the lift. The older basalts of Mounts Trumbull and Logan were poured out, and covered up the patches of Permian strata in the vicinity. The Colorado received fresh impetus, and began working its way downwards to a new base-level. The outer cañon was cut, and its floor is the base-level the river arrived at. The climate of the Pliocene period, succeeding the Miocene, was arid, and the river was not much aided in its work of erosion by side tributaries. Some which existed in the plateau region dried up, and left their side gorges opening high up in the cañon wall; and, of those which remained, most had their sources in the far-off highlands round the watershed.

After a period of rest, during which the river had time to widen the outer cañon for some miles, another upheaval began. The first lift had been one of 2000 to 3000 feet. This time it was greater, and amounted to 3000 to 4000 feet. The river began to excavate the inner cañon, and is still cutting downwards towards a new base-level. This upheaval was, like the first, accompanied by volcanic outbursts. The younger volcanoes of the Uinkarets emitted ashes and floods of lava, which gushed over the cliffs into the outer cañon, and, flowing across the great esplanade, rushed headlong into the inner chasm, which was not then so deep as it is at present, and formed a temporary barrier to the progress of the river. The great faults also belong to this series of movements. They cut sharply through the earlier volcanic rocks, but the more recent lavas cross

the lines of dislocation without the least sign of displacement. The movement must therefore have ceased several thousand years ago, before the last of the eruptions began. The old upheavals were paroxysmal, and interrupted by periods of rest, and it is possible that the earthquakes lately reported from Arizona may be connected with a new series of movements about to arouse the region from the centuries of repose it has lately enjoyed.

Since the dry climate began, the erosion of the plains bordering the Grand Cañon has almost ceased, as there is but little atmospheric waste and no running water to carry off the disintegrated materials. The erosion of the region is now almost entirely along the sides of the river. There is evidence indeed of a change of climate and a greater precipitation during the last stage in the evolution of the region. Many of the lateral cañons are slowly filling up with alluvium, which a perennial stream might easily remove, and there must therefore have been a time when the stream was strong enough not only to carry away the sediment, but to scoop out the rock below. This period corresponds to the Ice Age, which was here not icy but rainy. The ravines we have spoken of as radiating from the summit of the Kaibab, and affording to the lost traveller a clue to the labyrinth, were probably excavated by the running streams during this time of increased precipitation. The change in climate was only temporary, however, and all it effected was probably an increase in the volume of the streams, by which their transporting and eroding power was for a time enlarged.

In conclusion it may be well briefly to recapitulate the main lessons in geographical evolution which the Colorado is fitted to teach :—

1. **EROSIVE POWER OF RUNNING WATER.**—The geological structure of the plateaux shows that the present gorges in which the Colorado flows for long distances are entirely the work of running water laden with sediment, and are not fissures produced by terrestrial convulsions. Their present depth, which sometimes exceeds 6000 feet, only represents a small fraction of the whole cutting the river has performed since its birth.

2. **PERMANENCE OF RIVERS.**—The Colorado has continued to flow along its course since the end of the Eocene Period, when the great denudation of this part of America began. Mountains have been upheaved and worn away since that date, and volcanoes have lived and died within its basin, but it has outlived them all.

3. **SLOWNESS OF GREAT UPHEAVALS.**—The fact that the river has cut its way through the Uinta Mountains, which rose as a great barrier across its path, shows that the upheaval was so slow that the erosive action of the river could keep pace with the rising of the land. Had the upheaval been rapid, the river would have been deflected and turned into an altogether different channel.

4. EFFECT OF A DRY CLIMATE.—Tributary streams disappear and atmospheric erosion diminishes. Cliffs retain the sharp profiles they received when cut during a moister climate by running water, and rivers traversing arid regions tend to produce gorges and valleys with perpendicular sides, till, like the Nile, they reach a permanent base-level of erosion.

THE AUSTRALIAN ALPS.¹

TOPOGRAPHY AND OROGRAPHY.—Off the south-east coast of Australia, between Cape Howe and Sydney, the contour of the sea-bed shows an abrupt descent to a depth of 2170 to 2750 fathoms. This huge gully marks the western border of the vast subsidence area of the Central and Eastern Pacific, an area which is almost entirely girdled by a gigantic belt of active volcanoes. But here, in the western part of the Pacific, between New Zealand and the coast of Australia, and generally parallel to the latter between the points indicated, there exists this deep gully, which has in its rim neither active volcanoes nor important breaches. From this fact it may be inferred that this Australian depression is older in date than the broad subsidence area of the Pacific. The western wall of the depression curves steeply up to the surface of the ocean, and then towers up still higher in the mountain-system of the Australian Alps, which in general lie parallel to the coast, and are crumpled and folded along the line of their main axis. The Alps of south-east Australia belong therefore to an early geological period. And, indeed, they consist of granite and Silurian rocks, the latter much folded and metamorphosed, although in parts rich in fossils. In places, too, patches of Old Devonian limestone occur, as well as volcanic rocks, diorite and basalt, these last forming plateaux, as in the Bogong High Plains. The volcanic outbreaks to which these rocks owe their birth are assigned to the Devonian period. Scarcely any formations of younger date are to be met with in this region, with the exception of the Tertiary alluvial deposits which fill the beds of ancient valleys and lakes. But in no case do these Tertiary formations share in the plications of the older rocks; they lie either horizontal or with a very gentle inclination. The Silurian strata, on the other hand, are almost uniformly very steep or vertical. On the west and north the Australian Alps are skirted by the great Tertiary plain which now forms the basin of the river Murray. The elevation of the Alps seems to have taken place at a period earlier than the origination of the submarine gully which yawns at their eastern foot, and to be coëval with the subsidence of the Murray Plain.

The Australian Alps constitute a system of mountain-ranges lying in the south-east corner of Australia, and stretching from west to east, and

¹ Based on Dr. R. von Lendenfeld's study in *Petermann's Mitteilungen: Ergänzungsheft* No. 87: *Forschungsreisen in den Australischen Alpen*.



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from south to north, between the intersection of $145^{\circ} 30'$ E. long. with $37^{\circ} 40'$ S. lat., and the intersection of 149° E. long. with 35° S. lat. They describe a huge curve, convex towards the south-east, and measure from Melbourne to the valley of the river Yass, in New South Wales, a length of nearly 250 miles, with a breadth of about 120 miles. Northwards, beyond the Yass, they are continued in the Blue Mountains, Hunter Range, Liverpool Range, etc. These ranges last named belong to a region of Triassic basins, encircled by Carboniferous; the Carboniferous still further north spreads out to a belt 60 miles broad. In the Alps the foldings of the Silurian rocks are parallel to the long axis of the principal ranges. The western extremity of the main chain lies in $142^{\circ} 30'$ E. long., where that is crossed by lat. $37^{\circ} 20'$ S. At first it assumes a west-east direction as far as Mount Useful (3940 feet), a distance of 155 miles; there it is deflected towards the north-east, and curves round in an arc, open to the south-west, and embracing the head-waters of the river Mitchell. Beyond this curve the main chain sends off numerous outliers, subsidiary branches, and ramifications, which are so arranged as to give this part of the system the appearance of a much-crumpled, close-compressed region, which has at some time been subject to great lateral pressure from the west. Then the main range turns north-east, and finally north. At this part the central mountain mass bears the name of the Kosciusco Group (142 miles long), which contains Mount Townshend, the highest point in Australia (7353 feet).

Of the numerous ramifications which issue from the central part of the chief range, one of the most important is the Bogong Chain, which stretches inland east and north of the intersection of 37° S. lat. with 147° E. long. The culminating point in this chain is Mount Bogong (6749 feet), and several other peaks reach an altitude of 6560 feet.

Kosciusco Group is in reality an extensive plateau, crossed lengthwise from north to south by the main chain of the Australian Alps, the peaks of which rise on an average 2625 feet above the level of the plateau. The highest ridge, the mean altitude of which is 6890 feet above sea-level, traverses the western side only half a mile to 2 miles distant from its edge. In this ridge lie Mount Townshend (7353 feet) and Müller Peak (7267 feet).

The Bogong Chain lies between the Mitta-Mitta and the upper portion of the Ovens. Petrologically, its main constituents are the same as those of the Kosciusco Group, viz.—granite and Silurian rocks; but, in addition to these, there are Palæozoic limestone, volcanic breccia, basaltic lava, blue slate, gneiss, and basalt. Midway up the valley of the Mitta-Mitta the Silurian strata lie at an extremely steep angle, almost perpendicular, in fact, with a north-south strike. The southern portion of the Bogong Chain consists of the Bogong High Plains and several elevated peaks (Hotham, Cope, Feathertop, etc.), which together form an extensive plateau, and at the same time the most massive mountain knot in all Australia. The northern part of the chain is built up of granite and

gneiss. The southern plateau consists principally of basalt, and descends to the surrounding plains on every side by series of terraces. The whole of the Bogong Chain is traversed by volcanic seams, which converge upon a point in the southern part of the basalt plateau. The actual construction of these mountains was probably due to some such series of processes as the following:—A lateral pressure from the west, operating towards the close of the Silurian period, caused an upward bulging by which the Silurian strata were tilted vertically on end. Then came the period of Devonian sedimentation. Next, as an ultimate consequence of the plication in Silurian times, a breach was made, and through this the products of a stupendous volcanic outburst poured themselves, causing the surface to crack, and filling the fissures so formed with molten eruptive matter. It is also readily conceivable that at the precise epoch of the outburst a part of this region was covered with the sea, which would explain the almost contemporaneous deposition of the Devonian strata and the basaltic outflow from the eruption. Water and ice finally sculptured the mountains into their existing forms, and gave them the contour features they now present.

Between the main chain and the coast-line are a number of minor ranges, which, generally speaking, run parallel to both the coast and the principal axis of the Alps. The type of hill-form which predominates in the Alpine system is that of an extensive plateau with a rolling contour, and somewhat steeper slopes on its borders. The summits are throughout flat and rounded, and all are easily accessible, most of them indeed on horseback. The valleys are generally narrow, and seldom have steep walls; ravines and gorges do not occur at all.

HYDROGRAPHY.—The streams which have their sources in the Australian Alps are naturally classified in two sections. The first embraces those which rise on the north-western slopes, and direct their currents into the river Murray, which, after a circuitous course, reaches the Southern Ocean near Adelaide in South Australia. The second section includes those rivers which originate on the south-eastern flank of the Alps, and flow thence, for the most part in isolated channels, to the Pacific Ocean.

The river Murray rises south-west of the Kosciusco Group, flows northwards as far as 36° S. lat., and then westwards. Along this part of its course the Murray is joined by several not unimportant tributaries, all flowing from the south-east towards the north-west. The principal of these are the Mitta-Mitta, Kiewa, Ovens, Broken River, and the Goulburn. The basin of the Mitta-Mitta embraces an area of more than 1545 square miles; its chief affluent is Snowy Creek. The Kiewa has a total length of 97 miles, somewhat less than that of the Mitta-Mitta. But of all the tributaries of the Murray which have their origin in the mountains of the Alpine system the most important is the Murrumbidgee, which has at first a north-west direction, until, a little to the north of 35° S. lat., it

bends to the west, and for a distance of two degrees longitude skirts the Alpine region on the north. It finally unites its waters with those of the Murray in $143^{\circ} 20'$ E. long. It is instructive to note that in the case of both these rivers their principal tributaries come from the south, that they flow parallel to one another, and join the main stream as it runs westwards. Thus the more important valleys of the region strike off perpendicular to the long axis of the chief mountain ranges, whilst the secondary valleys open out parallel to that axis.

Of the numerous coastal streams those which seem to be particularly worthy of mention here are, going from south-west to north-east, the M'Alister, Mitchell, Nicholson, Tambo, and Snowy. All these rivers empty their waters into narrow lagoons, resembling the *Haffs* of Prussia, which are fenced off from the sea by long low spits of sand, through which the tide passes generally by only one narrow inlet. The largest of these streams is Snowy River, which rises on the eastern slope of Kosciusco Group, and drains an area of about 2700 square miles. At a point situated 3120 feet above sea-level, in its period of lowest water, a volume of 91,780 cubic feet per minute has been observed.

METEOROLOGY.—That Australia, taken as a whole, suffers severely from drought and scarcity of rain is a fact well known to everybody. But to this general description the Alpine region of the extreme south-east forms the most notable exception south of the districts which lie within the limits of tropical rains. The precipitation is especially heavy among the extreme coast ranges and along the line of the main chain of the Alps, the intervening tract arresting a less quantity of rain. At some places along the coast, as at Point Danger in New South Wales, the rainfall amounts to as much as 78·75 inches in the year. At Kiandra, north of the Kosciusco Group, the only meteorological station on the higher Alps, the rainfall is 51 inches annually. Between the Alps and the coast, at Cooma, the annual record of the pluviometer does not exceed 15·3 inches, and never falls below 10 inches. On the other side of the Alpine mountains the amount of rain that is precipitated decreases at a startlingly rapid rate, places within sight of the Alps often suffering severely from drought. The greatest quantity falls in April; the least quantity in December. The rainy season lasts from February to June. Moreover, whilst in the lowlands the precipitation is always rain, in the highlands it snows all the year round, and in winter it is never rain that falls. The mountainous regions are remarkable for their extraordinarily heavy dews. But the climate varies on the whole very greatly from year to year.

For lack of continued observations on the temperature in these mountainous parts of Australia, we must content ourselves with one or two facts about the temperature of Melbourne lying towards their western extremity, and about the limits and duration of snowfall. The mean for Melbourne, which in this respect resembles Verona and Bordeaux, is $57^{\circ}\cdot4$ Fahr. The mean of July, the coldest month, is $47^{\circ}\cdot66$. The highest

temperature observed at Melbourne is $111^{\circ}2$ in the shade, and 158° in the sun; the lowest $26^{\circ}6$. In the interior it is not at all rare for the thermometer to register $109^{\circ}2$.

At altitudes above 3300 feet, the snow remains for a couple of months or so; above 6600 feet it can be seen in suitable localities all the year round, even in the height of summer. It is interesting to compare the height of the snow-fields here with their height in the European Alps, where they are not met with below the line of 7910 feet—that is, for yet 1310 feet higher than on the Australian Alps. We must remember, too, that whereas the Alps of Europe lie on lat. 47° N. those of Australia lie on 37° S., and also that the rainfall in the former is considerably greater than in the latter. The explanation of this paradoxical phenomenon is that in Australia, as in New Zealand, the temperature decreases relatively to height at a more rapid rate than in the European Alps; and this circumstance again is, in all probability, due to the fact that the Australian Alps rise, as it were, isolated in the midst of the most extensive oceanic area of the world.

Contrary to what might be expected, considering the wide hot plains of the interior, the cloudless sky, and the watery girdle of the continent, the region of the Australian Alps is comparatively seldom visited by south-east winds. At Sydney, on the east coast, the prevailing wind, during the hot season, comes from the north-west, and at Melbourne, during the summer, north winds are very frequent; there, too, north-west, west, and south-west winds occur. Changes of wind from west-north-west to west-south-west are generally accompanied by great and sudden falls in temperature (as much as 68° in half an hour). Sydney, although it is situated four degrees nearer to the equator than Melbourne, is never scourged by such scorching winds from the hot and arid interior as visit the latter city. In winter, at Sydney, cool, dry west winds prevail; at Melbourne, in the same season, cool north winds. The Antarctic current which sweeps along the west coast of Tasmania into the eastern part of the Great Australian Bight, frequently gives rise to bad weather, with rapidly alternating winds, low temperature, and rain from the south-west. In the mountainous parts, and as low down as 2625 feet, bad weather is often accompanied with dense mists; but mist is very rare in the lowlands and on the coast. In general the atmosphere is remarkably transparent. A bright moonlight night in the centre of Australia is quite as light as an ordinary winter day in London.

FLORA AND FAUNA.—The relations between the flora of the elevated tracts and of the lowland plains are analogous to those which obtain under similar circumstances in Europe. Forest trees climb up as far as the 5580-foot horizontal line; then up to 6560 feet comes Subalpine flora (*Krummholz*); and beyond that again Alpine plants and low shrubs. On the loftiest peaks grow many beautiful Alpine flowers. The transition from the lowest to the middle zone is much more gradual than in the

European Alps; and the Subalpine flora consists almost exclusively of dwarf individuals of *Eucalyptus pauciflora*. In the lower valleys the forest trees are mostly species of *Eucalyptus* and *Banksia*, the trees shooting up tall and straight, without lateral branches. But whilst their average height is nearly 200 feet in the lower valleys, it is scarcely 10 feet at the upper border of the middle zone. The transition from this zone to the highest—the grassy—zone is extremely sudden and abrupt.

The fauna of the Alps is relatively poor. None of the large marsupials ascend very high, although wombats range up to 3300 feet. The only large animals are dingos (wild dogs) and wild horses. A few small singing-birds are to be met with on the meadows at the summits. Snakes are plentiful in the marshy valley bottoms, and occur also in the more mountainous parts. The pools of the higher districts are rich in water insects and the larvæ of *Neuroptera*. Peculiar interest attaches to certain night-butterflies, belonging to the group *Nocturna*, the caterpillars of which live in the humus of the highest grassy tracts, and occur in such multitudinous quantities that they serve the aborigines exclusively for food during two or three months in summer. A few fleas are also found at the highest altitudes.

GLACIATION.—In the southern hemisphere evidences of glacial action are far less common than in the northern hemisphere, which is, perhaps, mainly due to the smaller extent of land in proportion to sea; partly also, perhaps, to the paucity of our information about the fitting localities in the southern zones. In Patagonia glaciers descend to the ocean's edge in lat. 50° S. In the corresponding northern latitude they are never met with below 3300 feet above sea-level. In New Zealand again, where undoubted traces of glacial action on a considerable scale have been studied, glaciers occur on the west coast at altitudes of not more than 650 feet in lat. 44° S.; whereas in the European Alps, in lat. 46° 40' N., the lowest glacier of the system, the Grindelwald, does not descend below 3540 feet. That a Glacial Period once prevailed in Australia too, seems to follow conclusively from certain indications which have been observed both in the Kosciusco Group and in the Bogong chain, as well as in other parts of the mountains which occupy the south-east corner of the continent. In the Kosciusco Group, although no moraines and abraded summits (*roches moutonnées*) have been discovered below 4920 feet, yet certain unambiguous traces of glacial action, in the shape of abraded eminences, have been noted on the plateau. Also on the plateau of Mount Lofty, near Adelaide, glacial scars in a good state of preservation have been photographed. But the clearest indications exist in the Bogong Chain. There, at an altitude of about 2950 feet, a well-preserved moraine lies athwart a little valley situated to the north of Mount Bogong. The moraine is not very large, measuring only about 220 yards in breadth by 1100 yards in length, and some 115 feet in thickness at its outer edge. Besides this existing palpable witness, other indications are long lines of

erratic blocks of basalt on the sides of the valley of the Mitta-Mitta, some 490 feet above the present floor of the valley ; similar boulders on the slopes of Mount Bogong ; and glacial scratches on certain of the northern extensions of the Bogong Chain. In addition to these indications nearly a dozen others of less moment have been noted. The conclusion that seems justified by these facts is this : at some period, in all probability contemporaneous with part of the Tertiary Epoch, when a moister and more pluvial climate prevailed than what now obtains, the entire highland region of this part of Australia was subject to glacial influences, and in several places the ice-streams must have come down to great distances from the summits. That such a moist and wet climate did actually coincide with part of Tertiary time seems to be abundantly evident, both from the gigantic marsupials which then lived and from the presence of colossal masses of rolled detritus which are now found in many of the valleys, and which also point to the existence of rivers of more considerable size than those of the present day. It may also be pretty safely assumed that this glacial and pluvial epoch in Australia was coëval with the glacial period in New Zealand.

J. T. B.

GEOLOGICAL HISTORY OF LAKE LAHONTAN.

IN our insular climate of mildness and moisture, where all the rivers run into the sea, and all the inland lakes are fresh, we are apt to forget that there are wide regions of the earth's surface where opposite conditions obtain. One of the largest of these lies to the west of the Rocky Mountains, in the United States, between the range of the Sierra Nevada on the west and the Wasatch Mountains on the east. This vast area forms a hydrographic system by itself ; whatever water may enter it by rainfall, or by rivers rising on the mountains which bound it, is returned to the atmosphere by direct evaporation, none of it reaches the sea. Of the lakes occupying this region the most generally known is the Great Salt Lake of Utah. The history of early migration westwards across the desert, before the Pacific Railway was built or projected, records many a romance of suffering and adventure in the wild, arid plains, described as—

“Alkali, rock, and sage ;

Sage-brush, rock, and alkali ; ain't it a pretty page ?”

But these conditions inspired more horror than interest at that period. From time to time the Great Basin has been more or less cursorily examined, and its physical features recorded ; and a very detailed account of a portion of it has just been published by the Geological Survey of the United States.¹

This book is a model of its kind, precise and detailed as to facts, clear

¹ *Geological History of Lake Lahontan, a Quaternary Lake of North-Western Nevada.* By Israel Cook Russell. Washington : Government Printing Office, 1885.

in the expression of the resulting hypotheses, and written well and appreciatively. In fact, although no one could accuse the author of slurring over technical details, few persons, however ignorant of geology, who commenced to read the monograph would willingly relinquish so pleasant a task until the last page was perused. The subject-matter in itself is novel, varied, and interesting, but not so much so as to render it incapable of being greatly reduced in value by an unsympathetic or purely official style. This Mr. Russell has very happily avoided.

The book is a large quarto, composed of 288 pages of letterpress, a folding-map, forty-six full-page plates, and thirty-five woodcuts, all executed in the most perfect style of American art, and printed on the highly-glazed toned paper characteristic of Transatlantic Government reports. The maps are devoted to the delineation of various special features; in many cases vertical relief is shown, as well beneath the water surface as above it, by a very effective combination of contours, line shading, and colouring. The treatise is divided into chapters, which are subdivided into sections; at the close of every natural division a short summary is introduced in which the salient features described are briefly and clearly brought before the reader. A good, though not exhaustive, index completes the work.

We cannot do better than reprint Mr. Russell's preliminary abstract of the monograph, in order to convey an idea of the great range of questions touched upon and the general conclusions arrived at:—

“The present volume records the history of a large lake which flooded a number of the valleys of north-western Nevada at a very recent geological date, but has now passed away. This ancient water-body is known as Lake Lahontan—named in honour of Baron La Hontan, one of the early explorers of the head-waters of the Mississippi—and was the complement of Lake Bonneville. The former, situated mostly within the area now forming the State of Nevada, filled a depression along the western border of the Great Basin at the base of the Sierra Nevada; the latter, embraced almost entirely in the present Territory of Utah, occupied a corresponding position on the east side of the Great Basin, at the foot of the Wasatch Mountains. The hydrographic basins of these two water-bodies embraced the entire width of the Great Basin in latitude 41° . Lake Bonneville was 19,750 square miles in area, and had a maximum depth of about 1000 feet. Lake Lahontan covered 8422 square miles of surface, and in the deepest part, the present site of Pyramid Lake, was 886 feet in depth. The ancient lake of Utah overflowed northward, and cut down its channel of discharge 370 feet. The ancient lake of Nevada did not overflow. Each of the lakes had two high-water stages, separated by a time of desiccation. In the Lahontan Basin, as in the Bonneville, the first great rise was preceded by a long period of desiccation, and was followed by a second dry epoch, during which the valleys of Nevada were even more completely desert than at present. During the second flood stage the lake rose higher than at the time of the first high water, and then evaporated to complete

desiccation. The present lakes of the basin are of comparatively recent date, and are nearly fresh, for the reason that the salts deposited when the Quaternary lake evaporated were buried or absorbed by the clays and marls that occupy the bottom of the basin.

"As Lake Lahontan did not overflow, it became the receptacle for all the mineral matter supplied by tributary streams and springs, both in suspension and in solution. The former was deposited as lacustral sediments and the latter as calcareous tufa, or formed desiccation products when the lake evaporated.

"The Introductory Chapter indicates the position of the field of study, and contains a sketch of the Great Basin as the explorer finds it to-day, of which the desiccated bed of Lake Lahontan forms a part; also a brief notice of previous explorations, and an account of what was known of Lake Lahontan before the present study was begun. Routes of travel and areas surveyed are indicated on Plate II.

"Chapter II. (on the genesis of Lake Lahontan) contains a summary of the facts which show that the lake filled a compound orographic basin, resulting from the tilting of faulted beds. A description is given of the character of the irregular area whose drainage the lake received, together with an account of the outline and area of the basin which held the ancient lake. The question of outlet is discussed in detail, the conclusion being that the lake did not overflow (page 32).

"Chapter III. (on the physiography of the Lahontan Basin) contains a description of the region as it exists at the present time. The most distinctive characteristics of the valleys and mountains are briefly noticed; an account of the existing rivers is given, including measurements of volume, chemical composition, etc. The present springs of the basin are also described, and analyses of the waters of a few of them presented. These analyses are believed to represent approximately the character of the tributaries of Lake Lahontan. The existing lakes are next considered. These are Honey Lake, California; Pyramid, Winnemucca, Humboldt, North Carson, South Carson, and Walker Lakes, Nevada. Each of these is described with some detail with special reference to its geological bearings. All the lakes mentioned above, excepting Humboldt, are enclosed, *i.e.* are without outlet, and their waters are somewhat saline and alkaline, but not concentrated brines. They cannot, therefore, be considered as remnants left by the incomplete desiccation of Lake Lahontan. The Soda Lakes, near Ragtown, Nevada, are specially considered, and detailed observations are presented which show that they occupy extinct volcanic craters (page 73). Attention is given, on page 81, to the peculiar playas or broad mud plains of the arid region of the Far West, as well as to the temporary lakes, called playa-lakes, which frequently flood them.

"Chapter IV. (on the physical history of Lake Lahontan) is divided into sections. Section 1 contains a compendious discussion of shore phenomena in general.

"Section 2 is devoted to the presentation of the shore phenomena of

Lake Lahontan, and contains detailed descriptions and maps of the terraces, bars, embankments, etc., that were formed about its shores. The highest of the ancient water-lines is named the 'Lahontan Beach.' It indicates the maximum extent of the lake, as shown on the accompanying pocket-map. The most conspicuous terraces below the Lahontan Beach are the 'Lithoid,' 'Dendritic,' and 'Thinolitic.' Each of these marks the upper limit of a variety of tufa, from which it derives its name (page 102).

"Section 3 treats of the sediments of the lake, and presents detailed sections of the exposures observed. The sediments consist of two deposits of lacustral marls, separated by a heavy layer of current-bedded gravels; thus recording two lake periods and an intermediate low-water stage (page 43). Accumulations of pumiceous dust, white marl, and æolian sands are described under the head of Exceptional Sedimentary Deposits (page 146).

"Section 5 is devoted to the illustration of geological structure, as displayed in the lake basin, and is followed by a *résumé* of the physical history of the lake (page 169).

"Chapter v. (on the chemical history of Lake Lahontan) is also divided into sections. Section 1 treats of the general chemistry of natural waters as they occur in streams, springs, lakes, oceans, and enclosed lakes or seas, and is an introduction to the chemical history of Lake Lahontan.

"Section 2 is an account of the tufas precipitated from the water of the lake. These present three main divisions, named respectively—'Lithoid,' 'Thinolitic,' and 'Dendritic.' The first is a compact, stony variety, and is the oldest of the principal calcareous deposits that sheathe the interior of the basin. It occurs from a horizon 30 feet below the Lahontan Beach all the way down the sides of the basin to the lowest point now exposed to view (page 190). Thinolite is composed of crystals, and was formed in the ancient lake when it was greatly reduced by evaporation; its upper limit is about 400 feet below the Lahontan Beach (page 192). Dendritic tufa has a branching or dendritic structure, whence its name; it is superimposed upon the previously formed varieties. Its upper limit is 180 feet below the Lahontan Beach (page 201). The aggregate thickness of the tufa deposits is from 30 to, perhaps, 50 or 75 feet. Chemical analyses show that all the varieties are composed of somewhat impure calcium carbonate. Following the description of these deposits is a discussion of the conditions favouring the deposition of calcareous tufa from lake waters (page 210).

"Section 3 considers the salts precipitated from the waters of the lake when evaporation took place, and discusses the manner in which lakes may be freshened by desiccation (page 223).

"Section 4 contains an account of the efflorescences now forming on the surface of the deserts in the Lahontan Basin, and presents a brief description of the more valuable salt-works of the region, which are all supplied by the salts contained in Lahontan sediments (page 230).

"Chapter VI. presents the life-history of the ancient lake as determined from the abundant molluscan remains and other fossils that have been found. The shells show that the lake was fresh throughout its higher stages. During the period in which thinolite was formed, it seemed to be too concentrated to admit of the existence of molluscan life, as no fossils have been found in that deposit. A chipped instrument found in the upper lacustral beds indicates that man inhabited the Far West during the last rise of Lake Lahontan (p. 247).

"Chapter VII. is a summary of the history of the former lake (p. 250).

"Chapter VIII. contains a discussion of the Quaternary climate as determined from the records of Lake Lahontan. The periods of greatest lake expansion are correlated with the two glacial epochs of the Sierra Nevada, and are believed to indicate cold and moderately humid periods (p. 259). That the lake did not overflow is taken as evidence that the climate, even during the higher stages of the lake, was only moderately humid. The climatic changes that brought about such marked alterations in the character of the Great Basin are thought to have been of moderate intensity.

"Chapter IX. is devoted to a summary of the evidence bearing on the determination of the geological age of the lake. The conclusion reached is that it existed during the Quaternary, but was more recent than the date usually assigned for the close of the Glacial Epoch.

"Chapter X. brings the present study to a close, and contains an account of the orographic movements that have affected the Lahontan Basin since the last high-water period. The post-Lahontan faults actually observed are represented on Plate XIV."

It is difficult for one whose ideas of mountain and desert are derived from the hills and moors of our immoderately humid country, to realise the condition of those vast areas of internal drainage and constant evaporation where rain rarely falls. It is not only that the ground is covered with incrustations of soluble salts instead of soil, but the whole physical geography of the country owes its character to the climatic conditions. The contours of the mountains present none of the softened and blurred outlines produced by the action of moisture. They stand out bare and clear, free from all verdure, not changing in colour with the varying seasons, except when snow swathes the loftier summits, but flashing in the untempered sunlight, with magnificent variety of colour, the natural tints of the rocks themselves. Constant mirage gives a weird and magical aspect to the scenery, and the wonderful changes in visibility during the short twilight appear to modify the forms and distances of the peaks and ridges. Gravel bars, instead of being washed into a scattered sheet or swept away altogether, stand as compact and sharp in form as when first laid down by the waters of the vanished lake, thus giving an opportunity of studying the phenomena of lake structures that a European geologist would only look for in a freshly-drained inland sea.

The lakes which at present represent the long-vanished expanse of water are fully described, but most detail is given to the evidence of the existence of a former lake embracing the whole, and of the fluctuations of level to which it was subject. This evidence is very skilfully arranged, and brought forward in a convincing manner, the relative ages of the various terraces being proved by numerous sections and the analysis of deposits.

Perhaps the most remarkable feature of the water system of the Great Basin is the *playa* or temporary lake. In summer-time the traveller may ride over many miles of country upon a dead-level floor, of the appearance and hardness of cream-coloured marble, which stretches out to meet the horizon on every side. But in the short rainy season this area is flooded to the depth of a few inches, or of several feet, and becomes an impassable lake, which, as the evaporation produced by summer weather proceeds, dries up again and leaves an expanse of sticky, strongly alkaline mud, soon baked by the sun-heat into a solid pavement. Some playas are extremely shallow, and the evaporation or precipitation of an inch or two of water makes a difference of many square miles in their extent; others are deeper and more permanent. The water of playa-lakes being derived from the surface drainage of a nearly level country, the sediment is always in an extremely fine state of division, and accumulates to form a very saline clay. A very singular phenomenon—the freshening of lakes by desiccation—is frequently observed. A playa-lake gradually contracts, becoming salter and salter; the muddy water is finally dissipated, the aqueous portion as vapour, the dissolved and suspended matter as fine mud, which becomes hard and solid in the course of time. A sudden flood fills the lake with fresh water which cannot redissolve all the salts mixed up with the clay of the floor, but assists to cover them more effectually by laying down a new layer of sediment; and by several successive floodings and desiccations the soluble material may be entirely buried. Of course, if the flood came before the complete dryness of the lake, the salts would all be retained in solution.

The Lahontan Beach or high-water line of the ancient system is not found at present to be of equal height in all parts—that is to say, the terraces which marked as a horizontal ring the highest level of the lake are now by recent orographic movements displaced to a considerable extent. Along the lines of recent faults which have been traced out numerous hot springs occur, and it has been demonstrated that the more recent the dislocation at any place the hotter is the water issuing in that neighbourhood, thus confirming the theory that the shearing and compression of faulting strata, and not the internal heat of the earth, account for the appearance of hot springs.

By no means the least valuable part of the work is the chemical history of Lake Lahontan, which throws important light on the reasons of certain geological changes. The deposit of calcium carbonate from the water of the lake took place in three varieties, one of which, thinolite,

is of great interest. This form occurs in large, worn, quadrangular prismatic crystals from 8 to 10 inches long and from $\frac{1}{4}$ to 1 inch in diameter, tapering towards the ends. Each crystal is a skeleton built up of thin calcareous laminae projecting from the periphery inwards, and here and there the interstices are filled up with irregular grains of calcite or groups of acicular crystals of aragonite. These large crystals are pseudomorphs, but the nature of the original mineral is entirely unknown. It is proved by considerations of the level of the lake at the time of the deposition of thinolite, that the water must have been a tolerably concentrated solution of alkaline salts. By a very ingenious series of inferences and analogies, Dana was led to consider it probable that thinolite crystals were originally those of an unknown double salt of calcium carbonate and a soluble compound, probably either calcium or sodium chloride, and that after being deposited they were acted upon by the fresh water of the rising lake, which dissolved out the more soluble constituent and left the calcium carbonate as a skeleton. The question of the relation between calcium carbonate and solutions of alkaline salts is incidentally treated. In the sea the greater part of the lime contributed by rivers is withdrawn by living organisms for their shells; in very salt water, such as that of Great Salt Lake, the calcium carbonate is precipitated as river water enters, and laid down in the form of beds of oölitic sand. In less strongly saline lakes, where alkaline salts are abundant, thinitic crystals are supposed to have been formed, and in nearly "fresh" water very slight variations of the physical conditions led to the deposit of lithoid or dendritic tufa, the determining cause of deposition being apparently the escape of carbonic acid.

The geological history of Lake Lahontan is written as all monographs and text-books of Physical Geography should be written, and its appearance is not only a credit to the author and to the Geological Survey, but an honour to the Government of the United States.

THE NORWEGIAN NORTH ATLANTIC EXPEDITION.

BY WILLIAM E. HOYLE, M.A. OXON., F.R.S.E.

THE example set by the British Government in despatching first the *Lightning* and *Porcupine*, and subsequently the *Challenger*, to explore the bed of the deep sea has nowhere borne better fruit than in Norway. From time immemorial the Norsemen have had a passion for the ocean, and it was therefore to be expected that so soon as the possibility of making accurate observations of its greatest depths had been practically demonstrated they would be eager to follow in the path of discovery; indeed it must not be forgotten that the results of the dredgings of two Norwegians, Michael Sars and his no less illustrious son, were among the facts which raised a doubt in the minds of naturalists regarding the

existence of a bathymetrical limit to life, and thus led to the despatch of the expeditions to which allusion has just been made.

The Norwegian North Atlantic Expedition, to give a brief account of which is the object of the present article, originated in a petition, presented to the Norwegian Government on 19th March 1874, by H. Mohn and G. O. Sars, Professors in the University of Christiania. They set forth that, although much had been accomplished by the various British expeditions, there was a large stretch of water, now generally called the Norwegian Sea, in close proximity to their own shores, of which they, as a civilised nation, were morally bound to render an account, and they therefore begged that the Government would organise an expedition at the public expense, which should for a term of years spend the summer months in investigating this area. The proposal was favourably received, but two years elapsed before it took practical shape and the necessary preliminaries were arranged. A suitable vessel, the *Vöringen* (so named after a waterfall in the Hardanger Fjord), was hired for the purpose, and the necessary modifications were made in her at Bergen. She was a steam vessel built of wood, 144 feet long between the perpendiculars, 23½ feet beam, and of 344 tons burthen. Captain Wille, who was placed in command of her, paid a visit to England that he might consult with Captain Nares, then about to take charge of the Arctic Expedition. The result of this interview was that the arrangements on board the *Vöringen* were in most respects similar to those which had been found to work well on board the *Challenger*, a few modifications being introduced. Thus hemp rope was used in preference to wire for sounding purposes, as being safer; the Baillie sounding-machine, and accumulators similar in pattern to those of the *Challenger*, were adopted. The apparatus for bringing up samples of water from great depths was, however, constructed on a new principle; it held five litres, and consisted of a spiral tube, with a valve at either end worked by a revolving fan, which closed it when the line was being hauled in. The dredges were made in England, but were altered during the voyage, the mouth being widened by the addition of a thin sharp strip of metal along either edge. A piece of wood was furthermore attached at each corner to prevent the apparatus from sinking too deeply into the mud.

A general scheme of work was drawn up, which included the following items:—(1) Sounding; (2) Determination of currents, (3) of surface temperatures, (4) of the physical and chemical constitution of sea-water; (5) Zoology, (6) Botany, (7) Meteorology, (8) Magnetism, and (9) occasional observations.

CRUISE OF 1876.—The *Vöringen* left Bergen on June 1, 1876, under the command of Captain Wille, having on board Professors Mohn and Sars, Dr. Danielssen, Mr. Friele, Mr. Svendsen, and an artist, Mr. Schiertz. A few preliminary trials were made in the Sogne Fjord, in order to test the apparatus and accustom the men to its use in still water; this, with

the making of magnetic observations, occupied more than ten days, and it was not till June 20 that work in the open sea was commenced. The route lay first to the Færoe Islands, a gale of wind being encountered on the way, which necessitated some repairs. When these were concluded the vessel made for Iceland, the intention being to circumnavigate that island; but this scheme had to be abandoned owing to the season being too far advanced. A course was therefore made along its southern coast, and subsequently in a north-easterly direction, crossing the Norwegian Sea to Namsos, where a stay of six days was made. Thence a series of thirty-one soundings, four miles apart, was carried at right angles to the coast, and a number of dredgings were made in the Romsdal Fjord, whence the vessel returned to Aalesund, and finally reached Bergen on August 26.

On this cruise 98 soundings were taken, the greatest depth attained being 1861 fathoms, about half-way between Iceland and Namsos.

CRUISE OF 1877.—This year the *Vöringen* sailed from Bergen on May 23rd, but was obliged to put back owing to a defect discovered in her machinery, and in consequence of this and other delays, a definite start was not made till June 11. On this occasion the scientific staff consisted of Professors Mohn and Sars, Dr. Danielssen, Messrs. Schiertz, Friele, and Tornøe, the last-named having taken Mr. Svendsen's place as chemist. In the first instance, the vessel ran south as far as Stavanger, and, starting on June 13th, proceeded due north to the Arctic Circle: three parallel lines of soundings were then run at right angles to the coast, and some 70 miles apart, and on the 23rd the expedition reached Bodö. Three additional sections were then made between Röst and the Hadsel Fjord, after which Tromsö was made on July 8; and a few days having been spent there, two more sections were sounded out north of the Malangen Fjord. On July 24th the expedition set sail for Jan Mayen, sounding and dredging on the way. The island was approached from the east, but a thick fog prevailing, and a heavy sea beating upon that side, it was thought better to proceed to the other coast, and the vessel consequently passed northward, and rounded the north-east extremity of the island, anchoring in Mary Muss Bay as soon as the fog rose. On the 29th the expedition landed to the south of the "Fugleberg," a romantic cliff, the remnant of an ancient crater, which juts out from the narrow isthmus connecting the two rounded extremities of the island. The day was spent in shooting, sketching, and collecting natural history specimens. On the following day it was impossible to land, but dredgings were made in the bay from a boat, and in the afternoon the expedition got under weigh, in order to sound in deeper waters. Just at this time the first clear view was obtained of Beerenberg, the lofty peak of the island, "with his dazzling snow-clad summit, standing boldly out against the deep-blue northern sky." The vessel now repassed the northern extremity of the island, and anchored on the opposite side, in Great Wood Bay (Rækved Bugt). A few days were spent in surveying, dredging, sounding, and

taking serial temperatures off this side of the island. The height of Beerenberg was measured, and at the trifling depth of 20 fathoms a temperature below 0° C. was obtained, indicating the presence of the Greenland Polar current. Mary Muss Bay was again revisited on August 3, then South Cape was rounded, and the vessel stood due south and then east for some distance until, in lat. $68^{\circ} 21' N.$, long. $2^{\circ} 5' W.$, the greatest depth measured during the expedition (2005 fathoms) was sounded. This easterly line of soundings was continued to meet one previously run out from the coast, and then, after a call at Bodö, and a number of dredgings in the Skjerstad Fjord, the expedition finally landed at Bergen on August 23.

During this cruise 160 soundings, 27 dredgings, 9 trawlings, and 27 serial temperature observations were taken.

CRUISE OF 1878.—This year the expedition left Bergen on June 15, the scientific staff being the same as on the previous trip, and, proceeding northwards, taking serial temperatures and dredging in the Vest Fjord, called at Tromsö, and arrived at Hammerfest on the 22nd. On the 24th this port was again left, and the next few days devoted to exploration in the Porsanger and Tana Fjords. Sailing from Vardö on the 24th, the vessel proceeded with a wide easterly sweep to Beeren Island, where a box containing letters for the *Willem Barents* expedition was landed and buried; passing on to the westward and completing a wide circuit, the *Vöringen* returned to Hammerfest on July 8, and remained there five days.

On the next trip the course lay west-north-west to the furthest station reached on the previous year's cruise, and the same direction was maintained until the first floes of Greenland ice were encountered on the 17th; at this point the ship's head was turned due north, and by July 19th the 75th parallel of latitude had been reached, and the deepest water met with in the year 1878 (1885 fathoms) had been sounded. After dredging off Beeren Island, the familiar harbour of Hammerfest was once more sought, and whilst making for it the *Vöringen* passed in the fog within a few miles of the *Vega* under Nordenskiöld, neither vessel being aware of the proximity of the other. On the 29th a course was laid direct for Beeren Island, observations being taken on the way, when a gale interrupted further proceedings, and the *Vöringen* was obliged to anchor close inshore. Next morning, however, the weather had moderated sufficiently to allow of a landing being effected, and interesting explorations were made on shore, and many natural history specimens collected. The banks off the island were found to be frequented by numerous cod. Two sections were then run across the channel between Beeren Island and Spitzbergen; and South Cape, the southern extremity of the latter, was sighted on Monday, August 5. The expedition spent more than a fortnight in cruising about the western side of Spitzbergen, surveying and

dredging. It had been intended to visit Bell Sound, but a thick fog coming on, the vessel made directly for Norway, and the actual work of the expedition terminated at Bergen on September 4, where the majority of the scientific staff disembarked, Professors Mohn and Sars accompanying the vessel as far as Christiania.

On this cruise 117 soundings, 57 serial temperatures, 15 dredgings, and 25 trawlings were made.

A large quantity of scientific observations and material having thus been collected for investigation, preparations were made for publishing the results; these have been appearing at intervals during the last seven years in the form of quarto volumes, abundantly illustrated by plates, maps, and woodcuts. A most praiseworthy innovation is the printing of the text both in Norwegian and English in parallel columns, an example which might well be followed by writers of scientific papers in Slavonic and other tongues, which are even less intelligible to the world at large than Norwegian. The memoirs already published are as follows. —

- I. Chemistry. By Hercules Tornøe. 76 pp. 3 maps. 1880.
- II. Fishes. By Robert Collett. 164 pp. 5 pl., 1 map. 1880.
- III. Gephyrea. By D. C. Danielssen and Johan Koren. 60 pp. 6 pl., 1 map. 1881.
- IV. 1. Historical Account. By C. Wille. 46 pp. 1 map.
2. The Apparatus, and how used. By C. Wille. 54 pp. 1882.
- V. 1. Astronomical Observations. By H. Mohn. 23 pp.
2. Magnetical Observations. By C. Wille. 30 pp.
3. Geography and Natural History. By H. Mohn. 36 pp. 6 pl., 2 maps. 1882.
- VI. Holothuriodea. By D. C. Danielssen and Johan Koren. 95 pp. 13 pl., 1 map. 1882.
- VII. Annelida. By G. Armauer Hansen. 53 pp. 7 pl., 1 map. 1882.
- VIII. Mollusca. I. Buccinidæ. By Herman Friele. 38 pp. 6 pl., 1 map. 1882.
- IX. Chemistry. 1. On the Solid Matter in Sea-Water.
2. On Oceanic Deposits.
By Ludvig Schmelck. 77 pp. 2 maps. 1882.
- X. Meteorology. By H. Mohn. 150 pp. 3 pl., 1 map. 1883.
- XI. Asteroidea. By D. C. Danielssen and Johan Koren. 118 pp. 15 pl., 1 map. 1884.
- XII. Pennatulida. By D. C. Danielssen and Johan Koren. 83 pp. 12 pl., 1 map. 1884.
- XIII. Spongiadæ. By G. Armauer Hansen. 25 pp. 7 pl., 1 map. 1885.
- XIV. Crustacea. 1A, 1B. By G. O. Sars. 280 pp. 21 pl., 1 map. 1885.
- XV. Crustacea, II. By G. O. Sars. 96 pp. 1 map. 1886.
- XVI. Mollusca, II. By Herman Friele. 44 pp. 6 pl. 1886.
- XVII. Aleyonida. By D. C. Danielssen. 169 pp. 23 pl., 1 map. 1887.
- XVIII. A, B. Depths, Temperature, and Circulation. By H. Mohn. 209 pp. 48 pl., and maps. 1887.

GEOGRAPHICAL INVESTIGATIONS.

In reviewing the contents of the above enumerated memoirs, the geographical results first claim attention as being of most general interest. They were of necessity limited in scope, but by no means devoid of interest. They relate to four localities :—

1. THE VESTMANNA ISLANDS are a small group lying to the south of Iceland; the party landed here, and climbed Mount Helgafell, an extinct volcano, some 240 mètres (790 feet) high. A vigorous sketch by Mr. Schiertz, artist to the expedition, of the “Ystiklettur,” a striking cliff frequented by sea-fowl, is admirably reproduced in chromo-lithography.

2. JAN MAYEN was made the subject of more extensive investigation, and an excellent map, incorporating with original work the most reliable results of earlier explorers, has been drawn up by Captain Wille and Professor Mohn. The island consists of two rounded extremities united by a narrow isthmus, on either side of which is a lagoon of fresh water; that on the south-eastern aspect being much the more considerable. The north-eastern half of the island is not only larger than the south-western, but also much more elevated, containing the extinct volcano of Beerenberg, 6400 feet high, and covered with perpetual snow; from it large glaciers descend, some ten of them reaching the sea-level. The southern portion of the island, with an elevation of over 1500 feet, does not reach the snow-line, but its coast presents a number of fine hills and outstanding rocks, many of which are figured in Professor Mohn's geographical report. The position of the island was determined, and the results agreed very closely with those of Scoresby as regards latitude, whilst as regards longitude, the discrepancy was greater. Speaking generally, the island may be said to lie some nine miles further west than is shown in the charts in use up to the present time. The *Vöringen*, working with chronometers which were verified at short intervals, had exceptional facilities for determinations of this kind, and, moreover, her results agree with those of the *Willem Barents*. Professor Mohn points out and harmonises certain differences in the accounts of minor craters figured by Scoresby and Vogt. There are also some remarkable omissions in the enumeration of glaciers by the earlier explorers, and the question is raised whether any of these have undergone considerable change within recent times. The most remarkable instance is that of a large glacier running due south from Beerenberg, which is mentioned neither by the early Dutch and German writers, nor even by Scoresby, who was there in 1817, although he rowed past the place where it now descends to the sea. The first recorded notice of it is found in the pages of Vogt, who explored the island in 1861.

Dr. Danielssen collected eleven species of plants on the isthmus, four of which are Saxifrages, and Mr. Friele noted seven species of birds.

3. BEEREN ISLAND, about two-thirds of the distance from Hammerfest to Spitzbergen, was visited in 1878, and the height of Mount Misery, the

principal summit, was measured and found to be 544 mètres (1785 feet). Traversing the mountain is a conspicuous layer of peculiar rock, apparently columnar in construction. The coast is precipitous, with beetling cliffs, composed of horizontal strata, apparently belonging to the Carboniferous period. Off some of the headlands columns of rock remain, which are frequented by sea-birds as breeding-places. On an elevated plateau, about a mile from the coast, a chain of small fresh-water lakes was found, which are visited by innumerable wild-fowl.

4. SPITZBERGEN.—Here the most important addition to our knowledge was the survey, carried out by Captain Wille and Professor Mohn, of Advent Bay. This is a harbour much frequented by Norwegian fishing-boats, so that accurate knowledge regarding it is a matter of more than purely scientific interest.

(To be continued.)

GEOGRAPHICAL NOTES.

EUROPE.

Dutch Town Populations.—According to a paper in *Tijdschrift v. h. Ned. Aardrijksk. Genootsch.*, Ser. 2, Pt. 4, Nos. 5 and 6, by Mr. J. F. Hoekstra, the subjoined towns of Holland had, on 1st January 1887, each a population of more than 20,000 :—Amsterdam, 378,686 ; Rotterdam, 190,545 ; The Hague, 143,626 ; Utrecht, 79,166 ; Gröningen, 51,825 ; Haarlem, 48,159 ; Arnhem, 47,285 ; Leyden, 45,511 ; Tilburg, 32,016 ; Maestricht, 31,031 ; Nimeguen, 30,372 ; Dordrecht, 30,360 ; Leeuwarden, 29,472 ; Delft, 27,372 ; Bar-le-duc or 's Hertogenbosch, 25,906 ; Zwolle, 25,005 ; Schiedam, 24,806 ; New Amstel, 22,685 ; Deventer, 22,449 ; Helder, 21,545 ; Breda, 20,321. In addition to these, thirty-eight towns had between 10,000 and 20,000 inhabitants each. The total population of Holland on 1st January in the three years 1885, 1886, and 1887, was 4,278,000, 4,336,000, and 4,390,000 respectively.

Norwegian Trade in 1886.—From the report of the Norwegian Statistical Department (*Tabeller vedkommende Norges Handel*), for the year 1886, we extract the following particulars :—The total value of the imports was £7,511,110 (as against £8,088,890 in 1885, and £9,166,665 in 1881) ; the total value of the exports was £5,711,110 (as against £5,661,110 in 1885, and £6,716,665 in 1881). Amongst the imports the principal items were corn (£1,469,460), manufactured textiles (£1,225,460), coffee (£489,765), sugar (£669,110), molasses (£266,330), tobacco (£102,330), butter (£227,450), bacon and flesh (£228,320), iron and steel (£549,945), paraffin and petroleum (£589,055), and coal (£411,165). The exports are classified as follows :—Timber and forest products (£2,058,330), fishery products (£2,053,330), and other articles (£1,383,895). Under the last-named item are included—Nails (£144,555), butter (£128,110), hides (£127,890), woollen goods (£111,055), metallic ores (£83,055), paper (£56,720), boats, condensed milk, cotton, ice, hewn stone, dressed leather, raw copper, oats, glass, rye-meal. The commerce of Norway was distributed amongst the countries which follow :—Great Britain and Ireland (to the value of £3,805,060), Germany (£2,825,360), Sweden (£1,719,250), Russia

including Finland (£856,980), Denmark (£776,690), France (£615,120), Holland (£557,140), Spain (£481,770), Belgium (£461,380); the total value of the trade with non-European countries only amounted to £571,577. In the same year the industrial establishments of Norway turned out manufactured products to the value of £2,233,460.

[We have also received from the Norwegian Statistical Department statistical publications relating to mining (1883-85), crime (1884), education (1882), public railways (1885-86), budgets (1878-85), communal finances (1881-83).]

Political Map of Europe since 1815.—The following list, excerpted from *Le Mouvement Géographique* (31st July 1887), shows the changes which have taken place in the political map of Europe since the Vienna Congress of 1815 :—

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|---|--|
| 1830. Greece declared independent of Turkey. | 1861. Wallachia and Moldavia united as Roumania. |
| „ Moldavia, Wallachia, Servia constituted autonomous principalities under the suzerainty of Turkey. | 1862. Valley of Dappes divided between France and Switzerland. |
| „ The mouths of the Danube ceded to Russia by Turkey. | 1864. Ionian Islands granted to Greece. |
| 1831. Belgium declared independent of Holland. | 1865. Duchy of Lauenburg annexed to Prussia. |
| „ Kingdom of Poland suppressed. | 1866. Kingdom of Hanover, duchy of Nassau, electorate of Hesse, free town of Frankfurt, certain territories in Bavaria, Schleswig, and Holstein reunited to Prussia. |
| 1834. Principality of Lichtenberg reunited to Prussia. | „ Venice and Mantua ceded to Italy. |
| 1846. Republic of Cracow incorporated with Austrian Empire. | 1870. States of the Church and Campagna incorporated in Italy. |
| 1848. Neuchâtel becomes a free canton of Switzerland. | 1871. Alsace, except Belfort, and a part of Lorraine annexed to Germany. |
| „ Principality of Hohenzollern-Hechingen reunited to Prussia. | 1878. The Dobrudja given by Russia to Roumania in exchange for southern Bessarabia. |
| 1853. Jahde purchased by Prussia. | „ Servia increased and constituted an independent kingdom. |
| 1856. Southern portion of Bessarabia ceded to Moldavia by Russia. | „ Montenegro territorially enlarged. |
| 1859. Lombardy, with the exception of Mantua, abandoned by Austria, and acquired by the King of Sardinia. | „ Bulgaria constituted a principality tributary to Turkey. |
| 1860. Piedmont acquired the duchies of Modena and Parma, grand-duchy of Tuscany, Romagna, Umbria, the Marches, the kingdom of Naples, and Sicily. | „ Administration of Bosnia and Herzegovina handed over to Austria. |
| „ Nice and Savoy ceded to France by Piedmont. | „ Adakaleh (an island in the Danube) and Spizza acquired by Austria. |
| 1861. Kingdom of Italy constituted. | |

Nova Zembla.—Three separate expeditions have chosen this island for the scene of their labours during the current year. (1) *M. Wilkitsi* will make there a series of pendulum observations on behalf of the Russian Geographical Society; he is accompanied by Professor A. Grigorieff, the general secretary of the Society, as naturalist. (2) The Finnish scientist, Herr Heinrichson, will study the fauna and geology. (3) *M. K. D. Nossiloff*, besides studying the botany and geology, will carry on a series of regular meteorological observations, and observations on the movements of the ice in the Sea of Kara, and will further endeavour to construct an accurate map of the coasts and interior of the island.

Population of Greece.—In the spring of 1879 the population of Greece amounted to 1,679,775 persons, showing an increase of 221,881 since 1870. To these must be added 299,677, the population in 1881 of the Thessalo-Epirot districts incorporated with the kingdom of Greece in that year. Of these last 31,178 belonged to Arta (Epirus), and 262,815 to Larissa and Tricala together; the remaining 5684 were Thessalians and Epirots dwelling abroad. Thus the total population of all Greece, in the years named, amounted to 1,979,452. The total area over which they are spread is 24,552 square miles; of this area 18,341 square miles are embraced in the old provinces, 1040 belong to the Ionian Islands, and 5171 mark the extent of the newly acquired Thessalo-Epirot districts. According to density of population, there were 49·3 inhabitants to the square mile in the old provinces, 137 in the Ionian Islands, and 35·9 in the Thessalo-Epirot districts.—Dr. Ornstein in *Petermann's Mittheilungen*, 33 Band, No. 8.

Caucasus.—The President of the Alpine Club, Mr. C. Dent, accompanied by Mr. W. F. Donkin and a Swiss Alpine guide, ascended, in August 1886, the highest peak of the Koshtan-tau group of the Caucasus. This peak, the Tetnuld, was found (by aneroid measurement) to have an altitude of 16,550 feet. The Tetnuld is *not* identical with the Totonal; they are neighbouring summits of about the same height.

Dr. G. Radde intended to set out in July for the purpose of exploring the Ossetic Alps in the Caucasus. He will ascend the Lyachva, and investigate the mountains as far as the west of Kasbek, devoting special attention to the Koshtan-tau and the Dych-tau.

M. Déchy will again penetrate to the central part of the Caucasus during the course of the present year. The first object of his attention will be the Adai-Khokh group. Afterwards he will probably cross the southern slopes of Ararat, Lake Van, Lake Urmiya, and so reach Tabriz.

ASIA.

Dr. Bunge and Baron Toll.—These travellers, as we have already intimated, spent the greater part of the year 1886 on the islands of the group called New Siberia, lying off the north coast of Siberia between the mouths of the Yana and Indigirka. The principal islands of the group, New Siberia, Kotelnai (Kotelny), Liakhovsky, and Fadeyeff, were all visited. Baron Toll travelled all round the island of Kotelnai in forty days. From its northern extremity he saw, at a distance of about 100 miles, the unvisited Sannikoff Land, first seen by Sannikoff (a companion of Hedenström), in 1809. The greater part of the northern end of the island consists of Devonian deposits, whilst in the south the Trias is largely developed. The collections of flora yielded thirty phanerogams. The summer was a very unfavourable one, for the temperature only once rose as high as 50° F., and hardly a day passed without a snowstorm. The entire circuit of the

coast was blocked with ice, and in most of the valleys the snow did not melt. Meanwhile Dr. Bunge had been exploring the island of Great Liakhov. This, except for certain granite hills, shows a preponderance of Quaternary formations, namely, masses of ice, either pure or mixed with mud, and overlain by layers of clay, in which are an immense quantity of fossil bones. In addition to the well-known bones of the mammoth, rhinoceros, and musk ox, Dr. Bunge discovered skeletal parts of two other species of ox, of some deer, a horse, and various smaller animals. The flora was richer than that of Kotelnoi, yielding seventy phanerogams. Numerous worms and fresh-water crustaceans were found in little pools of water, notwithstanding the frozen state of the surface, for the temperature of the water rose in places to 60°-8 F. In other respects the summer temperature closely resembled that of Kotelnoi, except that there were perhaps fewer snowy days. Birds were less numerous on the islands of the group than from their geographical position had been expected. Reindeer, which occur more seldom on Liakhovsky than on Kotelnoi, cross over to the islands of the group on the ice in summer. Numerous ice-foxes live on the lemmings which frequent the islands. On Liakhovsky there were few fish; salmon were seen on Kotelnoi. Very few insects exist on both islands.—From *Petermann's Mittheilungen*, 33 Band, No. 8.

Ceylon.—Dr. F. Sarasin, who with his cousin, Herr P. Sarasin, spent two and a half years in the island of Ceylon for the purpose of studying its zoological features, and who traversed the island on foot in nine directions outward from a fixed centre, publishes a paper in the *Proceedings* of the Berlin Geographical Society (vol. xiv., No. 4), recording certain of his impressions, together with a provisional ethnological map, showing the distribution of the population according to race. Leaving out of account the Arabs and Moors, the native inhabitants of the island belong to three groups—Cingalese, Tamils, and Veddahs. The first two constitute the bulk of the population, the Cingalese being for the most part concentrated in the south-west, whilst the Tamils gather most thickly in the extreme north, in the island of Jaffna, and send off two streams, one along the west and one along the east coast. The Veddahs, who seem to be the remains of an aboriginal race who have now dwindled down to less than 2000, live in the depths of the primeval forests that still cover the north-east and east of the island. Until they were gathered by the Government into villages and settlements, and taught to grow coffee, the Veddahs used to live in caves and hollow trees. Previous to that they sustained themselves by the produce of the chase, their weapons being a primitive bow and an axe, whilst their only clothing consisted of leaves, and their shelter of small branches. Earthenware vessels were unknown to them until recently; and salt is not used by those who inhabit the interior. They stand at a very low ebb in point of civilisation, knowing nothing of class differences, showing not the slightest trace of artistic skill, having no sort of musical instruments, and lacking words for numerals and some of the days of the week. Their religion, a species of ancestor worship, is of the most primitive type. For their dead they generally display a callous indifference, which goes the length of seeing strangers exhume the bones of their relatives and carry them off. The Veddahs are small and mean-looking, the men averaging 5 feet in stature, and the women being somewhat less. Their skin is of a dark clouded chocolate brown. The hair, which is not crisp, but long and curly, frequently forms a confused mass clustering about the small and narrow head. The bridge of the nose is very low, and the nose itself flattens out considerably towards the tip; this gives the face a peculiar expression. The Veddahs are disappearing very rapidly, partly by absorption in the Tamil and Cingalese elements, and

partly in consequence of the ravages of disease. The two predominant races of the island, although they have lived on side by side for centuries, have never shown any tendency to amalgamate or mix. They are, it is true, separated from each other by a belt of forest 40 to 60 miles wide; but over and beyond this, the Cingalese, an Aryan race, have clung to Buddhism, whilst the Tamils, who are of Dravidian descent, belong to the Brahmanical religion.

The island of Ceylon is throughout nearly its whole extent a plateau elevated but little above the level of the sea. In the southern portion of the island, however, it rises in a series of terraces to a lofty mountain-knot, the summit of which forms the mountain-valley of Nuwera Eliya (5900 feet), fenced on at least one side by the culminating point of the entire mountain-mass, the peak of Pedrotallagalla (7870 feet). The west of this mountain-knot is formed by a gigantic wall of rock, crowned by rugged peaks; amongst these, and 1000 feet lower than the highest point, is the sacred Adam's Peak. On the summit of this mountain a small depression in the rock is fabled to be the spot last touched by Buddha ere he said farewell to the earth; this spot is visited yearly by vast numbers of pilgrims. The situation of this large mass of elevated rock (granite and gneiss), in the southern portion of Ceylon, is such as to give two quite different climates to the parts of the island which it separates from each other—to the west on the one hand, and to the east and north on the other. The western portion catches the rains of both monsoon seasons, and is consequently hot and moist; whereas the north and east, receiving the rains of the north-east monsoon only, are dry, and covered with an almost uninterrupted carpet of green forests. The districts of the west are, in respect of vegetation, thoroughly tropical, growing in luxuriant abundance numerous varieties of palms, the banana, mango, and bread-fruit tree. Here rice, fruit, and palms are cultivated everywhere. The lower slopes of the mountain region, up to 4920 feet, have been denuded of their original forest to make way for coffee-trees, and these in turn are now being supplanted by tea, cacao, and cinchona. The original forests still occupy for the most part a belt between 4920 and 6890 feet in altitude. In point of vegetation the districts to the east and north of the mountain-mass are comparatively poor, the forests dwindling in the most northerly parts to low bushes, with many *Euphorbiaceæ*.

Seul in Corea.—Mr. C. Nicholson discusses the last part of Dr. H. N. Allen's official work on the *Imperial Maritime Customs of China* in the *Revue Géographique Internationale* for February 1887. This part describes Corea and its capital, Seul, which is situated on the river Han, thirty miles from the sea. Seul contains some 150,000 inhabitants, and is a walled city. The situation is healthy and beautiful, the town being surrounded by pine-clad mountains, and the houses are solidly built and well ventilated. The use of coal, imported from Japan, is confined to strangers, who are the only people who employ stoves. The markets are well supplied, but pork, being considered the flesh of an unclean animal, is not generally used. The climate, except during the rainy season, is delightful. Winter commences in September, and attains its greatest cold in the second fortnight of December. The river is then frozen over. Towards the middle of July the rainy season begins, and the smallest brooks are then converted into disastrous torrents. The town lacks a good supply of drinking water, which can only be had from the water-carriers, who bring it from fresh springs in the environs. The sanitary condition of the Europeans who reside at Seul and at its port, Chemulpo, is generally very satisfactory, but the health of the native population is not so good, as they are not cleanly in their habits, dress in a fantastic and effeminate manner, and

lack energy. Women are rigorously secluded, and suffer in health in consequence. The children, also, of the better classes are sickly and scrofulous. Korean gentlemen usually take as concubines robust women from the working classes, and it is to their children by these women that appointments in the Government service are eventually given. The food of the poor consists of rice and vegetables, to which the better classes add beef, pork, game, and fish ; but all have a marked predilection for dog-flesh, which is largely eaten with all kinds of sauces, and is even used medicinally during the "dog days." Water is the ordinary drink of the people, and the use of tea is restricted, it being only taken medicinally. The alcoholic drinks of the Koreans, which they very much abuse, are much stronger than those of the Chinese. Wine in Korea is made from rice, and a sweet liquor obtained during the manufacture is largely consumed by the coolies. Barley furnishes a strong drink. Grapes are not used in wine-making, their use for that purpose being unknown ; besides, they are so rare that they are given chiefly as gifts in fine bunches superior to the Pekin grapes. Owing to the drinking habits of the Koreans, *delirium tremens* numbers many victims. Concubinage is regarded as a social necessity, and syphilis, which is called the "Chinese disease," is common. Leprosy exists in Korea in various and most repugnant forms. Blind people are as common as lepers. Epilepsy is surprisingly common, but is regarded as no bar to matrimony, and spreads rapidly in consequence. Bromide of potassium has hence become a very popular medicine. Smallpox is universal, children who have not taken it at the age of two years being inoculated with virus taken from a sufferer. Typhoid fever is very rare. In the houses of Seoul, men and women occupy separate apartments, but during the rainy and cold season, and in order to economise fires, men, women, and children may be found in a room eight feet square, breathing for hours a close atmosphere laden with smoke and the fumes of tobacco, which is indulged in by all the members of the family without distinction. The Koreans excel in the manufacture of the glasses of spectacles. They use transparent stones, which are finely ground, and form beautiful convex lenses which command high prices. A commercial treaty will shortly be signed between France and Korea.

Korean Commerce.—Three harbours in Korea—Yenchuan, Fusan, and Yuen-san—are open to foreign trade. The customs are controlled by Sir R. Hart, the head of the Chinese customs service. According to the report of the customs officials, the commercial condition of Korea in 1886, notwithstanding a failure in the rice crop in 1885, and the prevalence of an epidemic of cholera during the summer, showed a considerable advance on that of the preceding year. The total value of the imports in 1886 was 2,474,185 dollars (800,000 dollars more than in 1885), and that of the exports, 504,225 dollars ; but in connection with these last quoted figures it must be noted that the principal articles of export—silver and gold—are duty-free. Of the imports, rice was brought into the country to the value of 484,000 dollars ; shirtings, 1,107,670 dollars ; muslin, 128,387 dollars. The remaining articles of import consist of metals (iron, tin, copper), aniline dyes, kerosene oil, and silk. The greatest advance has been made by the port of Yuen-san, where the imports rose from 376,000 dollars in 1885 to 749,000 in 1886, and the exports from 388,023 in 1885 to 504,225 in the following year. Thus all the export trade of the country is concentrated in Yuen-san. The export of hides increased in value from 282,357 dollars in 1885 to 382,066 in 1886.—*Deutsche Kolonialzeitung*, 1st August.

Soundings in the Indian Ocean.—The United States ss. *Essex* (Commander T.

F. Jewell), whilst on a voyage from Ceylon to Malacca Strait in December 1886, made the subjoined soundings :—

Lat. N.	Long. E.	Depth in fathoms.	Sea-bottom.
5° 9'	85° 45'	2310	coralline.
5° 42'	87° 24'	2160	„ sand.
6° 3'	89° 32'	1707	„ „
6° 2'	89° 59'	1561	„ „
6° 6'	90° 46'	1443	mud and sand.
6° 8'	91° 24'	2001	„ „
6° 4'	92° 45'	2341	mud.
6° 2'	93° 35'	1186	mud and sand.
6° 2'	94° 22'	975	sand.

--*Ann. d. Hydrographie*, Heft 7, 1887.

AFRICA.

French Soudan (Senegal).—Lieutenant-Colonel Gallieni, writing from Diubé-Ba on 29th April 1887, furnishes the latest intelligence concerning the doings of the military column under his command in the eastern parts of Senegal. The French forces have completely routed the marabout Mahmadu Lamine, and subjugated the countries Uli, Diakha, Nieri, Tiali, and Gamu, all situated on the headwaters of the Gambia, and all more or less rich in gums, caoutchouc, indigo, earth-nuts, rice, cotton, and millet. The authority of the French Republic is now recognised throughout the valley of the Nieriko, that of the Upper Gambia, and portions of that of the Falémé. After the defeat of the marabout, two parties of officers set out on exploring expeditions to examine the districts between the Falémé and the Tinkisso (Upper Niger). One under Lieutenant Reichemberg traversed the region visited in 1884 by Dr. Colin, that is, Diebedugu, Kamana, Tambaoura, together with South Bambugu, Bafé, Konkadugu, and the course of the Falémé between Sansandig and Satadugu, the village where Mungo Park crossed the Falémé on his return from his first journey. All these districts, which yield abundance of gold, have been placed under the protection of France. The second party, under Captain Oberdorf, after crossing the Gambia at Badon and Medinakuta, and the Falémé at Erimana, reached Dinguiray, a region never before visited by a European. Thence they followed the river Kulu as far as Kita. Sirimana, Beledugu, Niocolo, Futofa, Dinguiray, and Kulu, on the Gambia, Falémé, and Ba-fing have likewise been placed under the protection of France. Besides these two parties, a third, under Captain Martin, which started from Medina, has proclaimed the French protectorate over Niambia and other districts to the south, between Kayes and Medina. In the preceding year a treaty was concluded with the powerful negro chief Samory, by which, whilst he retained all the territory on the left of the Niger as far as Kita, the French possessions are to include all the districts on the right of the Niger and the Tankisso, that is, Timani, Lokko, Tambakka, Talla, Tamisso, Hubu, Bailo, Morebedugu, Baleya, Duma, Keniera, Wassulu, Kabadugu, Kentilidugu, Worodugu, Bana, and Baniuko. Thus the protected states of France in this quarter of the globe extend on the right bank of the Niger from Segu to Sierra Leone and the Republic of Liberia, completely surrounding Futa-Jallon. Moreover, yet two other exploring parties have been sent out. Dr. Tautain, with Lieutenant Quiquandon, has gone north to explore the parts still unknown be-

yond Beledugu, and to endeavour to bring the Moorish caravans from Timbuktu to the French port of Bammako. The naval Lieutenant Caron has embarked on board a river steamer on the Senegal with instructions to open negotiations with the chiefs of Massina, Haussa, and Timbuktu, or rather Kabara.

With the object of strengthening his hold upon the districts he has conquered, Colonel Gallieni has established semi-military schools at Kayes and Bakel for training up the sons of native chiefs to be servants of the Republic; by this plan the young Negroes serve at the same time as hostages for the good behaviour of their parents and relatives. In addition to this measure, the French commander is also busily engaged laying out roads, and supplying them with the necessary bridges. A stretch of 125 miles from Kayes to Badumbé, along the Senegal and its tributary the Ba-khoy, has not only been surveyed, but is all prepared for the laying down of a railway line.—*Comptes Rendus (Paris Geog. Soc.)*, No. 12, 1887.

An Excursion of Lieut. Wissmann.—This traveller, whilst waiting at Lulua-burg, prior to setting out on his march for Lake Tanganyika, made a short trip to the south-east, going as far as the river Bushimaji, the most westerly of the three main feeders of the Lubilash. Beyond the native town of Tenda-Mota he encountered a population entirely different from any he had before met with in Africa. "The Kalosh, as well as the Bagna-Disho, Bagna-Mukenoli, who come next to them, live in enclosures containing from four to ten houses, in the midst of their fields, which are planted principally with sweet potatoes, some millet, and a little manioc of bad quality. As far as the eye can see, north and south, stretch lines of kraals or enclosures. The country is nearly everywhere cultivated; the only exceptions are a few narrow belts of prairie grass, whilst isolated clumps of low shrubs, three feet high, are seen occasionally. The water-partings are rounded ridges, with steep declivities, on which grow a few large trees. The banks of the brooks and streams produce no vegetation; here and there occur large beds of stones, and hills covered with sheets of broken granite. A few oil-palms and bananas stand around some of the kraals. The water is mostly bad. The people are, physically, well developed; many of the men stand six feet. All are muscular, and have large joint-bones, with heavy jaws; and they have a bold bearing. They adorn their persons with feather ornaments. Their hair they dress with clay and oil, forming it in front into little clots, and combing it backwards into a thick bushy chignon. They carry spears of hardwood and a club-like stick, which they never lay aside; some have also the broad Lunda knife. The country is greatly over-populated, far beyond the capacity of the soil to sustain. Small-pox is endemic. There is nothing at all in the country to attract the trader. The soil is too poor for tropical products; but seems eminently adapted for grazing cattle. The only domestic animals of the natives are sheep, goats, dogs, and poultry. I saw no pigs. The grey parrot seems to be absent from these districts. The nights were without exception cold, the minimum temperature being 42°·8 to 44°·6 Fahr. The people were very audacious in their behaviour. They possess a few firearms, which are imported from the south in exchange for slaves." Through the midst of this densely populated region Lieutenant Wissmann forced his way, at the expense of some fighting, three days' distance beyond the Lubi, turning back at the Bushimaji.—*Verh. d. Gesellsch. f. Erdkunde* (Berlin), Band xiv., No. 4.

Meteorological Observations at Entotto (Shoa).—Dr. Traversi, during his stay in the country of King Menelik, was able to make at Entotto (a place situated on the plateau of Abyssinia, at an altitude of 9320 feet above the level of the sea,

and 390 miles south-west of Assab on the Red Sea) a series of meteorological observations during a portion of the *krempt* or rainy season, viz. from 30th June to 24th September. The instruments he used were two centigrade thermometers and two aneroid barometers. During the months of July, August, and September—the rainy season—the wind blew with moderate force from points in the first quarter of the compass, north to east. When the wind veered round to the south-east the rain ceased, and fine weather set in. Hail fell frequently and in great abundance. During the interval named (30th June to 24th September), 889·3 mm. (= 29 inches) of rainfall were recorded; the greatest quantity that fell on any one day was 1·65 inches, and the average quantity for each day ·33 in. No rain fell on eleven days during this period. The barometer readings varied between a maximum of 542·6 and a minimum of 537·6; the average was 539·5. The thermometers ranged from 6·8 C. (= 44°·24 Fahr.) to 14°·8 C. (= 58°·64 F.), the average being 10°·3 C. (= 50°·54 F.). The thermometer stood lowest from 25th July to 7th August, and after 4th September it rose permanently.—*Bull. d. Sezione Fiorentina d. Soc. Afr. d'Italia*, iii. 5 and 6.

AMERICA.

British Columbia.—This, the only British territory on the Pacific seaboard of North America, which was formed in 1866 by the union of Vancouver Island with the continental part of the province, and five years later incorporated with the Dominion of Canada, seems destined to occupy an important place in the history of the Pacific Ocean. The new Canadian Pacific Railway has shortened the distance between England and China by more than 1000 miles; and the colony possesses an abundance of coal of first-rate quality, besides having excellent ports. British Columbia consists (1) of a large tract of territory on the mainland, lying approximately between 60° and 49° N. lat. and between the Pacific and 120° W. long.; (2) of Queen Charlotte, Vancouver, and a great number of smaller islands. The territory, about 700 miles long by 500 broad, has an estimated area of 350,000 square miles. Orographically it consists of the two mountain chains, the Rocky Mountains and the Coast Range, embracing between them a belt of irregular plateaux, whilst a tract of 31,558 square miles of fertile agricultural soil, well wooded, and with a mean elevation of 2000 feet above the sea, called the Peace River District, is situated on the east of the Rocky Mountains. The Rocky Mountains rise abruptly from the prairie regions of Central Canada; and within the limits of British Columbia their ramifications, mostly divided by parallel valleys that run in a north-west direction, have a general breadth of 60 miles. Between parallels 51° and 52° the ramifications spread out more widely, and at the same time diminish in height. The islands of Vancouver and Queen Charlotte are in reality the highest parts of a huge chain of mountains whose base lies below the level of the Pacific. The coast-line is extremely irregular and broken, doubling back into a vast number of creeks and bays, and forming numerous islands with intricate channels between them. Principally owing to its situation and the physical characteristics of the country, British Columbia enjoys a more temperate climate than the regions in the same latitude on the Canadian side of the Rockies. The narrowness of Behring Strait prevents the icebergs and masses of drift ice of the Polar seas from entering the Pacific; the Rocky Mountains lying athwart the province in a north-west direction shield it against the cold Arctic winds; a warm Pacific current washing its shores and warm winds blowing off the same ocean from the south-west, conjoined with the general north-south direction of the valleys, greatly moderate the rigour of its

climate. On the island of Vancouver the cultivable soil is found principally in a belt of low ground, from two to ten miles wide, which extends between the mountains and the sea on the south and east. The best agricultural district of the mainland is the Lower Fraser Valley, the soil of which consists of very fertile alluvium. In the valleys of the interior, and on the rolling country, cereals yield excellent results, the fruit-trees of temperate regions are grown, good pasturage is found, and a variety of red pine thrives almost everywhere. Further north, beyond 51° N. lat. and west of the river Fraser, lies the low rugged district of "New Caledonia," which has in general a tolerably fertile soil, and is covered with almost impenetrable forests. Peace River District, on the east of the Rocky Mountains, consists of rich arable land and rolling prairies, and is on the whole well wooded. The population of the province numbers about 75,000, of whom 12,000 are congregated in the capital, Victoria, which is picturesquely situated on the south-east coast of Vancouver Island. The principal town in the continental part of the province is New Westminster, on the right bank of the Fraser, with 6000 inhabitants. The export trade of the colony is confined to the produce of its mines, fisheries, and woods—precious stones, coal, salmon, oil, timber, peltry, hides; the import trade embraces all sorts of manufactured goods and provisions. Amongst the mineral wealth of the country may be named gold (in the western ramifications of the Rocky Mountains), coal (on the west coast), iron (near the coast), silver (Fraser Valley and Kootenay district), copper, together with some mercury, antimony, platinum, and bismuth.—Extracted from a paper by M. Jules Peltzer, in *Bull. de la Soc. Roy. Belge de Géogr.*, No. 3, 1887.

The Gran Chaco, Argentine Republic.—The northern portion of the energetic State of South America called the Argentine Republic is a region about which very little was known until 1884, when a military expedition was sent to subjugate the Indians inhabiting that part. This, which bears the name of El Gran Chaco, is a region about $4\frac{1}{2}$ times the size of Switzerland, being 113,000 square miles in area (according to other estimates, 164,550). Its comparatively level surface is only broken by spurs of the Andean system on the west; by several lagoons, which act as back-water reservoirs for its rivers in their periodical seasons of overflow; and by its three principal rivers—the Pilcomayo, the Vermejo, and the Salado. Except in the immediate neighbourhood of these rivers the country is covered with primeval forests. It lies at an altitude of nearly 1000 feet above sea-level, and consists of alluvial soil of recent formation. The Pilcomayo, which flows south-eastwards into the Paraguay, joining it below Asunción, the capital of the State of Paraguay, forms the northern boundary of the Gran Chaco, and separates the Argentine Republic from Paraguay. The eastern frontier of the Gran Chaco is marked by the rivers Paraguay and Parana; whilst on the north-west, west, and south it runs conterminous with the Argentinian provinces of Salta, Santiago del Estero, and Santa Fé. Of the other rivers named, the Vermejo, so called from the red colour of its waters, rises near Tarija in Bolivia; breaking through the ramifications of the Andes in the province of Salta, it divides into two arms, which after about 60 miles again reunite; and finally it pours its waters into the Paraguay. The Salado, also flowing south-east, roughly speaking, parallel to the Pilcomayo and the Vermejo, traverses the western and southern parts of the Gran Chaco, and joins the Parana. Its breadth varies between 130 and 200 feet, whilst its average depth is $6\frac{1}{2}$ feet. Its water contains a noticeable percentage of saline matter. The temperature of the Gran Chaco is in general very high: during the summer months (November to February) it rises to 96°-8 Fahr.; but this heat is tempered by southern winds and copious rains, so that in the morning and evening, and during the night, it is cool and

refreshing ; also a heavy dew falls regularly every night. The vast forests are naturally rich in timber, and contain several kinds which are valuable for industrial purposes. Of the numerous species of trees there are at least forty of those peculiar to the Gran Chaco whose wood or bark or fruit possesses properties of value to man. Then there are also the fig-tree, the laurel, lemon, wild quince, peach, mulberry, cochineal ; a number of plants yielding aromatic and medicinal substances ; and several trees with native names, from which are obtained tannin, nuts, sugar, meal, albumen, and an intoxicating liquor. As might naturally be expected in a region so rich in forests and water, there is an abundance of animal life, the chief varieties represented being the jaguar, fox, otter, beaver, wild hog, armadillo, deer, monkeys, birds, reptiles. A species of frog, of large size, bites in such a way as to cause a violent fever. Insects seem to be a pest ; mosquitoes, gad-flies, and large ticks are particularly active. The Argentinian Government has lately taken steps to explore the northern part of the Gran Chaco, with a view to its colonisation, viz. the part between 27° 18' and 28° 12' N. lat., and 59° 40' and 60° 10' W. long., a region covered with slightly saline grasses, and having a soil which seems to be excellently adapted for growing the sugar-cane, tobacco, maize, earth-nuts, hemp, water-melons, and various vegetables, as well as rice ; but not for cereals generally, because the summer rains usually fall when they would be ripening. In these districts the temperature reaches in spring 70°·8 Fahr., in summer 78°·8, in autumn 79°·6, and in winter 55°·76. The Indian population of the Gran Chaco is estimated to be between 20,000 and 40,000.—Herr E. Weber in *Geogr. Nachrichten*, 15th May 1887.

CHILI.—The Chilian Captain Serrano has, within quite recent years, conducted two explorations of the river Palena, a stream which flows into the Gulf of Corcovado, south-east of the Island of Chiloe. The Palena is, it seems, a more important waterway than was hitherto supposed, for it has in its lower course a width of 2625 yards, and is navigable for a considerable distance. From Serrano's second trip, and from an investigation conducted by the government of Chili, the remarkable fact has been ascertained that the water-parting between the Atlantic and the Pacific slopes in those regions is not coincident with the main chain of the Andes, but is a plateau lying to the east of it, and having an altitude of some 1640 feet. The rivers which rise at its foot and flow into the Pacific issue from small lakes and pierce the Cordillera in difficult ravines. The country between the eastern slope of the Andes and the plateau consists of pampas, well suited for cattle. This discovery of the true watershed will affect the boundary-line between Chili and the Argentine Republic ; for by treaty that line "shall run along the highest peaks of the Andes which mark the water-parting."—*Petermann's Mittheilungen*, 33 Band, No. 8.

Venezuela.—The President of the Republic of Venezuela has commissioned Senor Vincenzo Marcano to make a scientific exploration, especially of the anthropology and geology, of the State of Guzman Blanco, and of the territories of Alto Orinoco and the Amazons. Senor Marcano is further charged to construct maps of the regions studied, a desideratum very urgently needed.—*Boll. Soc. Geogr. Ital.*, July 1887.

Greenland.—A new expedition to the north-east coast of Greenland is now being prepared in Denmark under the auspices of Herr A. Gamel, who in 1882 fitted out the *Dijmphna*. The expedition, which will be under the command of Lieutenant Hovgaard, who filled the same office in the *Dijmphna* in 1882, will attempt to discover the sound which is believed to extend from the east coast to the west coast in about lat. 70° N.

OCEANIA.

New Guinea.—We have received an account, published by Messrs. Black & Co., of Mackay, Queensland, of an important inland journey, which seems to indicate a feasible route across the peninsula of south-east New Guinea, undertaken in July and August 1886 by Dr. Clarkson and Mr. Hunter. Instead of attempting, like Mr. H. O. Forbes, to reach Mount Owen Stanley by crossing the difficult Astrolabe Range, Dr. Clarkson, landing at Kappa Kappa, 30 miles south from Port Moresby, turned this range at its south-east extremity, where an extensive level tract of fine fertile country intervenes between the termination of the Astrolabe and the outlying spurs of the Macgillivray Range. Up this tract, which forms the valley of the Kemp Welsh River, the party proceeded, having Mount Obree in front of them. The progress was slow, owing to the state of warfare in which the tribes live, and, in spite of much patient diplomacy, they were forced to turn, after getting within two days' journey of the lakes, which, the natives said, lie at the foot of Mount Owen Stanley, and whence, they added, a practicable route crosses the hills to the north coast. Strong resemblances were observed between the palisaded towns of the interior and those of the mountain country of Fiji (Tholo), and the appearance and language of the two peoples seemed also to have something in common. The return journey on rafts down the Kemp Welsh River was rapid and easy.

The subjoined details, evidently relating to part of the journey mentioned above, are extracted from the journal of Mr. Hunter. From the coast, as far as the line of the Garier Hills, the country consists of thick scrub lands with open grassy flats. These hills, "bearing about north-west, are in many parts thickly grassed to the summits; on the tops of the hills are situated six of the principal and most warlike villages of the [Garier] tribe; they cultivate sugar-cane, bananas, yams, and taro. Their villages are built on the highest and rockiest points of the hills. Being a strong tribe, mustering between two and three thousand, they don't build in trees, as many weaker tribes do, for safety. They are tall and strong men, rather darker in skin and coarser in feature than the coast tribes. The houses are smaller than on the flat country, owing to the difficulty of procuring building material. The gardens are made in scrub lands on the sides of the mountains. Great quantities of pigs run about the villages, and are very tame, following their owners to and from the gardens. The natives do not bury their dead as the coast natives do, but when one of them dies the relations build a stage alongside of the house, and leave the body exposed on it until putrefied, putting their wooden dishes underneath to catch the matter which comes away from the body. This they mix with yams and eat. When a chief dies, the natives leave the village and live in the bush for a time. They don't think that a man dies from natural causes, but think he is killed by the 'devil' of some other tribe, and very often kill some other man they think is the cause of it." The natives of a village (Sarowah) in the same neighbourhood, who speak a different language from the Garier tribes, dry their dead in the sun, and put them away in the bush, tied up in the bark of the palm-tree. Right away from the coast ridge to the banks of the Kemp Welsh the country is flat and open, well-grassed, and watered by creeks which flow into the Kemp Welsh; patches of scrub and bald hills are also scattered about as far as the slopes of the hills on the north-west. Some distance up, the Kemp Welsh is joined by a creek called the Tahoro, the lower part of whose course runs parallel to the left-hand arm of the main river. Between the two,

just above the source of the Tahoro, stands the village of the same name, perched on the top of a steep grassy hill 2000 feet high. On the opposite side of the Kemp Welsh is another hill (Mount Douglas) nearly 3000 feet high, and covered with dense scrub to the top. To the south-west are ranges of grassy hills, and open country down the river; whilst up-stream the surface becomes rougher and breaks into a high mountainous region. Opposite Mount Douglas the river was about 100 yards wide and about 4 feet deep. In this part the barometer ranged from 28.50 to 30.20. Some 12 miles higher up, the Kemp Welsh, which throughout has a very tortuous course, makes a large bend, and flows over a deep stony channel, having a range of high-peaked mountains on the east, and a high range on the north running parallel to the river. About a mile further up the mountains approached close to the water's edge, being steep and clothed with grass. Here the eastern range appeared to terminate, the country beyond being all level right away to the foot of the great range of which Mount Obree and Mount Brown are prominent peaks. Generally speaking, in all the villages visited by Mr. Hunter along the course of the Kemp Welsh the natives exhibited a shy and timorous disposition, fleeing to hide themselves at his approach.—Condensed from *Proceedings and Transactions of Queensland Branch of Royal Geographical Society of Australasia*, vol. ii. pt. 1, 1886-87.

Tucopia.—"Far away in the Western Pacific, in lat. 12° 21' S. and long. 168° 40' E., lies the lonely little island of Tucopia. It may be 5 miles in circumference, and rises in the form of a rugged compressed cone to a height of nearly 3000 feet. It is thickly covered, to the highest peak, with dense tropical forest and vegetation, among which can be observed from seaward occasional clumps of bread-fruit trees and cocoa-nut palms. On the south-west side, jutting out from the mountain base, is a low sandy flat, covered with palms, which appears to be the centre of population, and off which point is the only anchorage the island affords. It was discovered by Queiros, the Spanish navigator, and afterwards visited by Captain Edwards in H.M.S. *Pandora*, sent from England in search of the mutineers of the *Bounty*." The inhabitants are described as being physically the finest race in the Western Pacific. They have a bright copper complexion, and most of them regular and highly intelligent features, without the slightest trace of Papuan blood. Scarcely one can be found under 6 feet, and they are stout in proportion. "The hair, which is worn long, is by the constant application of lime burnt to a reddish colour. They are tattooed over the chest, thighs, and arms with forms of fish, and other savage devices. Like the Malays, they chew the betel-nut, which imparts to the lips a bright red colour, and to the teeth an enamel resembling black marble. They believe in a good and bad spirit, and, like the natives of Rotumah, in the worship of ancestors. Their manners, customs, and traditions, with the construction of their language, point unerringly to a common origin with the Samoans of Eastern Polynesia."—Captain John Mackay, in *Proceedings and Transactions of Queensland Branch of Royal Geographical Society of Australasia*, vol. ii. pt. 2, 1886-87.

MISCELLANEOUS.

Herren Kund and Tappenbeck are about to head a party for the exploration of the country to the east and north of the German colony of the Cameroons.

A numerous and carefully equipped expedition is to be despatched during the course of the present summer by the Finland Society for Botany and Geology

to the interior of the peninsula **Kola**, principally for the purpose of making observations in natural science.

It is reported that a rich American company has equipped and sent out to the Congo Free State an expedition called the **Sanford Exploring Expedition**, after the former American Minister, Mr. Sanford, for the purpose of exploring the **Kassai**, **Sankuru**, and **Lomami**.

Mr. Stanley, in a letter to Colonel Sir F. de Winton, dated "Camp at Yambuya Rapids, Aruwimi River, June 19th, 1887," announces his arrival thus far on his great journey, only eight days behind the estimated time. So far all had gone well, and the leader was looking forward to the completion of his work, full of confidence and hopeful courage.

The *British North Borneo Herald* of July 1st describes an ascent by **Mr. R. M. Little** of **Kinabalu Mountain**. Estimating the height of the highest (Victoria) peak on the rim of the crater, which he did not ascend, at 250 feet, **Mr. Little** found the total height of the mountain, by aneroid, to be 11,562 feet, which is more than 2000 feet below the usually accepted height of 13,698 feet. Judging from the appearance of the summit, he concludes that the ancient crater must have been shattered into its present form by two distinct eruptions.

The December (1886) issue of *Timehri*, the *Journal of the Royal Agricultural and Commercial Society of British Guiana*, contains a paper on the **Caribs** of the Antilles, from the pen of the Jesuit Father De la Borde,—the narrative, a condensed translation from the French, by **Mr. G. J. A. Bosch-Reitz**, being "the first of a series of reprints of the literature of West Indian and Guiana red-men, which it is proposed to publish from time to time in *Timehri*." A great part of the volume before us is taken up with an account of the plants observed during the **Roraima** expedition of the editor, **Mr. E. F. im Thurn**.

According to intelligence which has reached Brussels from Zanzibar, **Lieut. Wissmann** has successfully accomplished his journey from Luluaburg to the shores of Lake Tanganyika (see p. 255, May number), where he arrived at the beginning of the month of April. Thence he made his way to the east coast, following pretty closely the route of **Dr. Oscar Lenz**,—that is, the region to the south-east of Lake Tanganyika, Lake Nyassa, the **Shiré**, and the **Zambesi**. This makes the tenth time, in chronological order, that this portion of Africa has been crossed from ocean to ocean, and it is the second time that **Lieutenant Wissmann** himself has accomplished the feat,—the first European who can claim the honour of such an achievement.

Dr. G. A. Wilken's name appears in *Bijdragen tot de Taal-, Land-, en Volkenkunde van Nederlandsch-Indië* (v., 2, 3) as the author of a long dissertation on **Shamanism** amongst the peoples of the East Indian Archipelago. After showing its connection with such abnormal states of the nervous system as hysteria, hypnotism, catalepsy, etc., and with insanity, he passes on to describe shamanism as it occurs amongst the **Battaks** of Sumatra, the **Malays** in Sumatra (in **Bengkalis**) and on the Malay Peninsula, the **Dayaks** of Borneo, the **Alfuras**, **Macassars**, **Buginese**, and other peoples of Celebes, the **Tinguianes** of Luzon (Philippines), and the **Alfuras** of Halmahera (**Gilolo**), **Ceram**, **Buru**, and others of the South-Western Islands.

NEW BOOKS.

The Scenery of Scotland viewed in connection with its Physical Geology. By ARCHIBALD GEIKIE, LL.D., F.R.S., etc. 2d Edition, pp. 472. Two Maps, Index, and copious Illustrations. London: Macmillan and Co., 1887. Price 12s. 6d.

The first edition of this delightful volume has long been out of print. During the twenty-two years which have slipped away since it was written, Murchison, Lyell, Sedgwick, Phillips, and Scrope have all passed away, and Ramsay has retired from active life after a long and bright career. The stony science has itself undergone great changes in these years. Theories which a quarter of a century ago gained but scant acceptance are now regarded as axiomatic truths, and structures have been discovered of whose existence geologists of the last decade did not so much as dream. Among the former is the theory of Denudation—a doctrine which Mr. Geikie, in his original edition, was one of the first to expound to general readers. The hills and dales of Scotland are not, he showed, the products of titanic earthquakes and convulsions which have torn and twisted the surface into its present varied forms. They are the work of the biting frost, the pattering rain-drop, the surging stream, and the silent grinding glacier. All these tools have left their mark imperishably graven on our country's face, and, with the exception of the last, are still working as busily as of yore. This unromantic explanation of their origin has seemed to many almost a stain on the escutcheon of our Highland bays and valleys. "Even where some knowledge of the results of geological investigation has been obtained," says the author, "the influence of the old fondness for cutting the Gordian knot of geological problems by recourse to earthquake and upheaval still makes itself felt. Men are unwilling to recognise that the question of the origin of scenery is really so complex as those who have most closely studied it maintain it to be. And so they make short work of the difficulties, referring all the intricacies of the configuration of the land to the results of subterranean convulsion."

The volume is divided into four parts. In the first, which is devoted to Land Sculpture in general, the author dilates on Nature's Sculpture Tools, the Sea and its work on the Scottish coast-line, Glaciers, Icebergs, and the History of Land Surfaces. Each subject is discussed in the clear and graceful language which makes Mr. Geikie's books so readable and attractive. The second division of the volume relates to the Highlands, their Scenery and Structure. There is a short account in Chapter VI. of the recent important discoveries, made principally by the Scottish Geological Survey, in the North-West Highlands. The work of the Survey has proved that the Highland rocks have been altered, by vast pressure, into their present form since the Silurian period, but what their original character may have been is not always clear. East of the Great Glen the metamorphism has not been so intense as in the North-West Highlands, and the recent discovery of organic remains shows that they are, in part at least, equivalent, as Murchison supposed, to the fossiliferous Lower Silurian formations of Sutherland.

In Chapter XI. a very interesting account is given of the ancient glaciers of the Highlands. The text is illustrated by an excellent map showing the path by which the ice moved seawards from the ice-fields on either side of the Great Glen during the coldest part of the Glacial Period. This map marks another advance in geology during the last quarter of a century. The Boulder Clay or Glacial Drift was first attributed to the action of water, and then to icebergs, but as observations were multiplied the iceberg theory had to be abandoned,

and it became apparent that nothing would explain the observed phenomena but a sheet of land-ice radiating outwards from the main Highlands, like that now enveloping Greenland or the Antarctic continent.

The two remaining divisions of the book are devoted to the Southern Uplands and the Midland Valley. One of the last chapters is on the Influence of the Physical Features of Scotland upon the People. This very interesting subject is worthy of more attention than it usually obtains.

The text is enriched by eighty-five woodcuts, most of which are from original sketches by the author, and are of great beauty from an artistic as well as from a geological point of view. Figs. 7 and 8, representing the character of the Old Red flagstone cliffs of Caithness and Orkney are, we think, particularly excellent.

The geological map at the end of the book shows the latest additions to our knowledge of the Scottish rocks. Considerable modifications will be observed in this very variegated picture since the author's well-known geological map of Scotland was published. The most notable changes are in Perthshire, Aberdeenshire, the counties round the Moray Firth, and the western part of Sutherland. These districts are at present being systematically examined by the Scottish Geological Survey, and maps of the work on the 1-inch Ordnance sheets are being issued every year. Changes are also observable in the colouring of Skye, Mull, and several parts of the West Coast.

This edition has an itinerary appended which extends over fifty pages, and adds materially to the value of the book, as it points out all the more important geological localities and tells how to reach them. Mr. Geikie knows his native land, its scenery and rocks, better than any other man living, and he has here made full use of his enviable power of graphically describing, by pencil as well as by pen, what he has seen during many years of travel among its glens and mountain fastnesses.

St. Kilda and the Kildians. By ROBERT CONNELL. London and Glasgow : Thos. D. Morison, 1887. Price 2s. 6d.

This, the fifth book on the outmost islet of the Hebrides since the Rev. K. Macaulay described it in 1764, is a republication, in an expanded form, of articles contributed to a Glasgow newspaper by its special correspondent, who accompanied the relief expedition sent at the instance of Principal Rainy and Sir William Collins in 1885, and again resided fifteen days on the island in 1886. The writer describes the people, who are lessening in numbers, and somewhat caricatures their religiousness, while doing justice to the ladies of the Free Church of Scotland, who send them a good schoolmaster every year. He recommends emigration, at the instance of the seventy people themselves. The scientific and physical facts are few, and not new.

The British Empire. By Sir GEORGE CAMPBELL, M.P. Cassell and Co., London, 1887. Pp. 184. Price 3s.

Although this volume does not fall strictly within the domain of Geography, we gladly call attention to it, for within a small compass it raises and states concisely, and on the whole with fairness, a number of important questions which the political geographer cannot afford to neglect; and at all events on the subject of India, which occupies one-third of the work, any opinions expressed by Sir G. Campbell will be received with respect. The merits and disadvantages of crown colonies and protectorates, of self-governing colonies, and of territorial chartered companies, are also passed in review. As regards the great question of annexation, the author does not agree with the doctrine enunciated by Mr. Gladstone that the time has come when all extension of the empire should

cease ; he rather, while advocating the greatest circumspection, holds that each proposal for annexation should be decided on its own merits. And this has always seemed to us, looking on the British Empire as still a healthy living organism, the more statesmanlike view. Sir G. Campbell indeed goes so far as to regret that, having India on our hands, we cannot quite undertake the regeneration of Africa besides !

Local self-government in India, the best form of government for mixed communities like the West Indies or South Africa, and the occupation of Egypt are among the other weighty questions which are raised rather than adequately discussed.

The Great Silver River. Notes of a Residence in Buenos Ayres in 1880 and 1881. By Sir HORACE RUMBOLD, Bart., K.C.M.G. With Illustrations, partly from Sketches by R. S. Wilkinson, C.E. London : John Murray. 1887. Pp. xiv. + 330. Price 12s.

Books upon the Plate region, and the social, economical, and political aspects of life there, abound. In comparatively few, however, is an interesting and valuable store of information found in combination with the charm of manner which characterises this work by Sir Horace Rumbold. The reader enjoys so much the good fellowship and good humour of the company he is in, that it is not till he has got to the end of a chapter, or to the end of the book, that he begins to realise how much more intimately acquainted he has become with persons and places in the Argentine Republic and the adjoining territory. What Sir Horace Rumbold has to say concerning the conditions and prospects, political and social, of the Plate countries, and the capabilities of the region as a field of colonisation, may be commended to the careful study of intending emigrants and investors, but may be passed over here with the note that, in the author's opinion, the future of this rich and healthy country between the Andes and the ocean belongs less to the resident Hispano-American population than to the new races which are crowding into it from Europe. Where the interest of his pages is more purely geographical is in the chapters in which he describes a voyage made with a party of engineers to the head of navigation on the Uruguay and the sites of the old Jesuit missions adjoining that stream. On the Brazilian side of the stream the resources of civilisation are represented by the presence of a strong naval force, the officers of which "are much given to copy English ways and customs, and have even started a kind of cricket." In the distracted regions of Entre Rios and Misiones, however, brigandage, modified by lynch law, still largely prevails ; and this "vast Argentine Mesopotamia," as Sir H. Rumbold calls it, affords a great field for the explorer. An intelligent young Argentine, whom the author met on his voyage, gave him an interesting account of a journey he had just made through the interior of the provinces mentioned, from the Parana to the Uruguay. He assured Sir H. Rumbold that "even the accurate and painstaking Petermann was out in his topography of the district. As an instance of this, on his map the large Laguna of Iberá is represented by a chain of smaller lakes, the fact being that it is one vast sheet of water—half swamp, half lake—some forty leagues, or 120 miles, in length. The bosom of these mysterious waters is said to be covered with floating islands, which on examination would no doubt be found to be acres of reeds and rushes and other aquatic plants, the queen of which is the colossal *Victoria regia*, similar to those which choke the current of the rivers of equatorial Africa." An example of the incorrectness of Petermann's map was met with by the

author himself a stage or two later, when what is marked as the "pueblo" of San Matio was found to be an island.

Ten Years in Melanesia. By the Rev. ALFRED PENNY, M.A., late of the Melanesian Mission. With Chart and six Engravings. Pp. 232. London: Wells Gardner and Co., 1887. Price 5s.

This book is mainly devoted to a narrative of missionary progress in that part of the world which has been made known to us in connection with the work of such men as the Selwyns, Patteson, and Dr. R. H. Codrington, author of *The Melanesian Language*. Mr. Penny's descriptions of the native customs and superstitions are full of interest; and he also gives useful information concerning the labour traffic, the chief exports, the geological features, and animal life of the islands. The book is furnished with a chart and several sketches.

Uebersichten der Weltwerthschaft. Von Dr. F. X. VON NEUMANN-SPALLART. Jahrgang 1883-84. Stuttgart, 1887.

This valuable compendium of economic statistics deserves to be better known in this country than it probably is. Its 574 pages are full of carefully collected, and as carefully arranged, information on all departments of commerce and means of communication. At a glance the reader may learn what position any country he is interested in holds as a contributor to the world's stock of grain, or cattle, sugar, tea, coffee, beer, coal, iron, cotton, gold, and their monetary representatives, etc., etc.; or how it stands in relation to shipping, railways, telegraphs, postal facilities, etc. The author estimates that the total foreign commerce of the world in 1885 amounted to 61,693,000,000 marks (£3,084,650,000), less than it was in any of the years 1880, 1881, 1882, 1883, 1884, and especially much less than it was in 1883 (the maximum year), when he estimates the total at 67,864,600,000 marks. A serviceable list of statistical publications (arranged according to the several countries) concludes the work.

The Teaching of Geography: Suggestions regarding Principles and Methods for the Use of Teachers. By ARCHIBALD GEIKIE, LL.D., F.R.S. Macmillan and Co., London, 1887. Pp. 202. Price 2s.

This is a very perplexing book. It is so full of suggestive matter and so well written, that it is a pity to have to find fault with it. The methods recommended by Professor Geikie for imparting to young learners the elementary principles and first ideas of the science are excellent, and in all respects admirable. But, having said that, one feels constrained to qualify it by adding, alas! it is not all Geography. In fact, the author has formed a conception of Geography which greatly transcends the strict limits of the science, even on a liberal interpretation of its definition. Surely he wanders from the domain of Geography, when in Chapter IV. he recommends the formation of small collections of stones, plants, and animals, to be employed in the course of practical teaching. In our desire to make a subject concrete and interesting, we must not forget the danger of crushing it beneath an over-great burden of accessories. One very excellent and novel feature of the book is the way in which surrounding objects, howsoever commonplace and familiar, are made subservient to the teacher's purpose. This is a sound principle to work upon—that of vitalising the dry bones of facts and figures and rote-lists, and vitalising them moreover by infusing into them the quickening influences of the local and the familiar. But again, we repeat, it must not be overdone: let us not choke our plants and hide them with a superabundance of straw and netting and scarecrows. All this deprecatory criticism will not, however, diminish the real value of the book,

which is full of interesting information, and pregnant with material for thought, and not for the teacher of Geography merely, but also for the general reader. Of the many valuable things contained in the book, we would draw special attention to Chapter x., which treats of local geographical nomenclature, of money, roads, the post-office, telegraphs, historical collections, etc., and shows how they may be made subservient to the teaching of Political Geography.

Longman's New Geographical Readers: The First Reader for Standard I. Longmans, Green, and Co., London, 1887. Pp. 128. Price 9d.

The little volume which lies before us is admirably adapted to fulfil the purpose which it has in view, viz. to teach the young mind how to grasp the first elementary notions of Geography. It has been "written to meet the requirements of the New Code of 1887, and in accordance with the instructions to Her Majesty's Inspectors." The language is of course simple, and the method partly graphic. A few of the great fundamental facts of nature are lucidly presented; and we would especially call attention to the clear explanation of the theory of map-making, which so often proves a puzzle to youthful learners. The harder words which occur throughout the work have been culled and placed in a list at the end, which will doubtless prove a great help to the beginner. A certain degree of care has been taken with the illustrations, which are realistic and well drawn. The paper is good, and the type clear and firm.

Great Waterfalls, Cataracts, and Geysers. By JOHN GIBSON. Thomas Nelson and Sons, London and Edinburgh, 1887. Pp. 238. Price 2s. 6d.

This book gives an account of some of the important waterfalls and geysers which occur throughout the world. Nothing can be grander than to see a stupendous mass of water hurl itself over the beetling brow of a precipice to be dashed into spray on the rocks at the base; and the author of this book evidently enjoys such a scene to the utmost. The book begins, as it should begin, with a description of that fall of falls, Niagara. Various interesting facts connected with the fall are mentioned, and a striking illustration of the whirlpool is appended, which gives us a vivid idea of the dangers which proved so fatal to that brave but unfortunate Englishman, Captain Webb. Various other American falls are next treated of; and a description is given of the marvels of the Yosemite Valley in California which makes us long to visit it.

The author next turns to Africa, which, dry and arid as a great part of it is, yet affords him plenty of material for his subject in the falls of the Congo, Nile, Zambesi, and Senegal. Then follows a description of the waterfalls of Europe. The comparatively insignificant Falls of Clyde might well have made way for the waterfalls of Norway. Another curious omission is that of the falls of Italy, of which some (Terni, Tivoli) have not only a world-wide, but a century-long renown. The book closes with accounts of the most conspicuous instances of those wonderful natural phenomena known as geysers. In our estimation this is the most interesting part of the work. It is curious to note that geysers occur in three parts of the world so widely separated as Iceland, the United States (Yellowstone Region), and New Zealand. The Yellowstone Region, with its brilliantly coloured natural baths, the water of which changes everything into stone, seems to realise the fabled stories of fairyland. The book is got up in an attractive style; the illustrations are well drawn; and the type is clear and firm. Did the author write up to his illustrations, we wonder; and did they determine the choice of the particular falls, etc., treated of?

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE CAVES OF STAFFA.

BY COPE WHITEHOUSE, M.A., F.Am. G.S.

"A physical fact is as sacred as a moral principle."—LOUIS AGASSIZ.

IN the course of scientific researches on the frontier of human thought it fell to my lot to examine the current opinion in regard to Fingal's Cave. The subject assumed unexpected dimensions. Vaguely conscious at the outset that there must be some mistake in the representations of this world-renowned object, I am now inclined to think that the annals of human error will be searched in vain for a parallel. There are certain conclusions of science which must remain esoteric, with certain laws of motion and of morals. There are, however, other facts which only require statement, where there is no innate tendency to error, and the truth is as easily grasped as falsehood. Fingal's Cave belongs to this latter class. It is also free from any accretion of truth. It sometimes happens that a mistake or a fraud becomes invested with concentric layers of the purest thought and emotion. It is not in me to shatter a shrine because a monk, in his pious but fraudulent zeal, put a chance bone where a mother's tears, or a nation's gratitude for some imaginary benefit, have built around it tomb and abbey. Here there was no such cause to close the eyes. At best a few verses, whose poetic beauty would scarcely be affected, adorn a discovery which Science had always maintained her claim to discuss. The subject was therefore at my disposal, and I have made considerable use of it. It resolved itself into two practically independent inquiries. The one traced the gradual degradation of fact and the development of falsehood by a persistent survival of the unfittest. The other went to the root of the whole matter, and

raised a question which, if answered as I think it should be, shows that, after all, there was a germ of misapprehension in the first utterance. It was the struggle to reconcile facts with an imaginary cause that finally produced the obvious errors which it became my function to indicate.

So far as the illustrations are concerned, my task may be considered accomplished. In regard to the more recondite statements of fact, and the inference to be drawn from them, I can point to the practically unanimous decision of every scientific body to which I have been allowed to present them. On the other hand, the controversy cannot be considered at an end, because the opinion of the Geological Society of France has recently been challenged by the Director-General of the Geological Survey. His high position and great influence compel me to concede that a dissentient opinion published by him in his latest work materially detracts from the unanimity which I had apparently secured, and induces me to re-open the question, and re-argue it.

When Sir J. Banks, in 1772, having been refused permission by the Admiralty to join the second expedition of Captain Cook, carried his staff of draughtsmen and experts to Iceland, he little foresaw that it was an islet in the Hebrides which would confer upon him a fame transcending even his ambitious imagination. He owed it to a mere accident. In his own words :—"In the Sound of Mull we came to anchor on the Morven side, opposite to a gentleman's house called Drummen. The owner of it, Mr. MacLean, having found out who we were, very cordially asked us ashore ; we accepted his invitation, and arrived at his house, where we met an English gentleman, Mr. Leach, who no sooner saw us than he told us that about nine leagues from us was an island where he believed no one even in the Highlands had been, on which were pillars like those of the Giants' Causeway ; this was a great object to me who had wished to have seen the Causeway itself would time have allowed. I therefore resolved to proceed directly, especially as it was just in the way to the Colum-Kill ; accordingly having put up two days' provisions and my little tent, we put off in the boat about one o'clock for our intended voyage, having ordered the ship to wait for us in Tobirmore, a very fine harbour on the Mull side." He added in a foot-note :—"When I lay in the Sound of Iona, two gentlemen from the isle of Mull, and whose settlements were there, seemed to know nothing of this place ; at least they never mentioned it as anything wonderful." It will be observed that it is Staffa and its basaltic columns, not the caves, of which Banks compounded the intricate sentence which I have just quoted. So, too, Pennant said : "Nearest lies Staffa, a new Giants' Causeway, rising amidst the waves, but with columns of double the height of that in Ireland ; glossy and resplendent from the beams of the eastern sun. Their greatest height was at the southern point of the isle, of which they seemed the support. They decreased in height in proportion as they advanced along that face of Staffa opposed to us or the eastern side ; at length appeared lost in the formless strata ; and the rest of the island that appeared to us was formed of slopes to the water's edge,

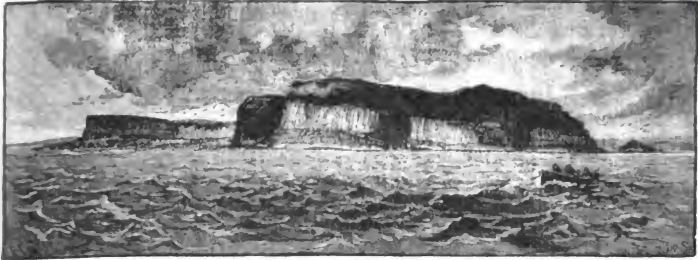
or of rude but not lofty precipices. Over part of the isle on the western side was plainly to be seen a vast precipice, seemingly columnar like the

Cormorant's Cave.

Boat Cave.

Fingal's Cave.

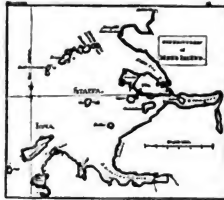
Mull.



Staffa from the South. Engraved for Mr. Cope Whitehouse.

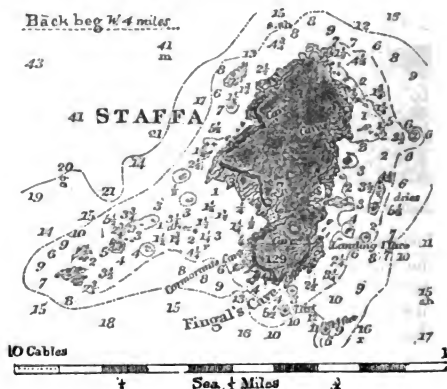
preceding. I wished to make a nearer approach, but the prudence of Mr. Thompson, who was unwilling to venture in these rocky seas, prevented my further search of this wondrous isle. I could do no more than cause an accurate view to be taken of its eastern side, and of those of the other picturesque islands then in sight."

He added a foot-note in reference to "the beautiful group of the *Treashnish* isles," that "these are most erroneously placed in the maps a very considerable distance too far to the north." He gave an excellent map of the west coast of Mull Island on a scale of two miles to the inch. Those who availed themselves of the great privilege offered by the Royal Scottish Geographical Society in Aberdeen will remember how the space between Dutchman's Cap and Iona is suddenly diminished when the cartographers adopted this correction. Pennant even noted the shoals that protect Staffa on the west, and although "Relin" seems to be somewhat at sea two miles north-west of Iona, it is, in fact, the Bogha Reidh of the Admiralty chart, No. 2617. On this map of Pennant's, therefore, it is apparent that Staffa is in the centre of a circle, of which half is formed by Mull, and two-thirds of the remainder by a series of islets and shoals, nowhere over five miles distant. The two charts (Nos. 2617 and 2652) make it still clearer that Staffa is in a basin whose waters attain a depth of 70 fathoms, but whose rim, except in a very few places, never sinks below twenty fathoms. Further, although 40 fathoms may be found within a cable-length of the north end of Staffa, where the island is lowest, the water shoals to 20 fathoms over two miles to



Reduced Chart from Pennant's
Tour, 1774.

the south-west in the direction of apparent greater exposure and "the rocky seas" dreaded by Mr. Thompson. A good engraving shows how the columnar basalt passes into the grassy slopes of the north-east, while a very short causeway projects at the southern foot of the columnar precipice. Undoubtedly Banks permitted himself to use somewhat exaggerated language in reference to its Irish rival, but it would be hypercritical indeed to make this the subject of serious censure.



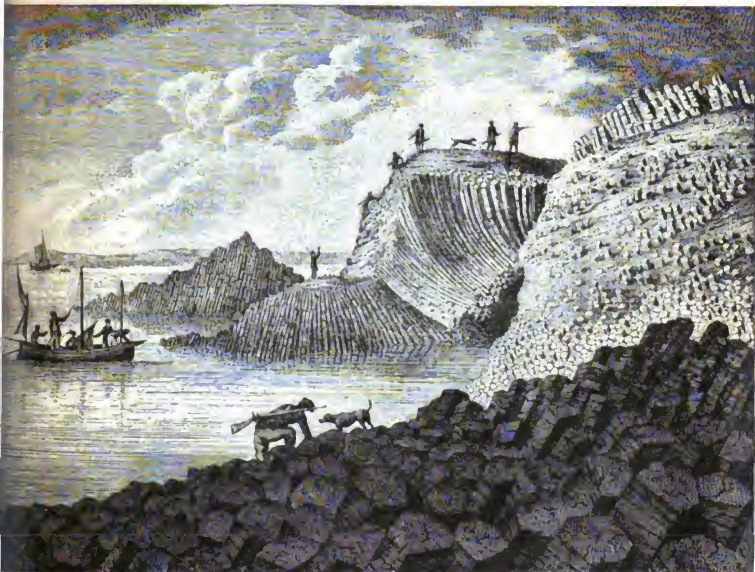
From the Admiralty Chart.

Returning to Sir J. Banks, he "found it too dark to see anything," so carried his "tent and baggage near the only house on the island," and began to cook his supper, "in order to be prepared for the earliest dawn, to enjoy that which from the conversation of the gentlemen we had now raised the highest expectation of. The impatience which everybody felt to see the wonders we had heard so largely described, prevented our morning's rest; every one was up and in motion before the break of day, and with the first light arrived at the south-west part of the island, the seat of the most remarkable pillars, where we no sooner arrived than we were struck with a scene of magnificence which exceeded our expectations, though formed as we thought upon the most sanguine foundations; the whole of that end of the island supported by ranges of natural pillars, mostly above 50 feet high, standing in natural colonnades, according as the bays or points of land formed themselves, upon a firm basis of solid unformed rock; above these the stratum which reaches to the soil or surface of the island varied in thickness as the island itself formed into hills or valleys."

In spite of his unscientific frame of mind, and the dim light of the early dawn, these words are sufficiently just. These same men had been a few days previously in the weird and Titanic scenery of volcanic Iceland, yet

they truly found in the Isle of Columns a unique exhibition of a form of so-called basalt which has not yet been satisfactorily explained. Banks naturally indulged in a rhapsody. "Compared to this"—i.e. the mass of

Clamshell Cave.

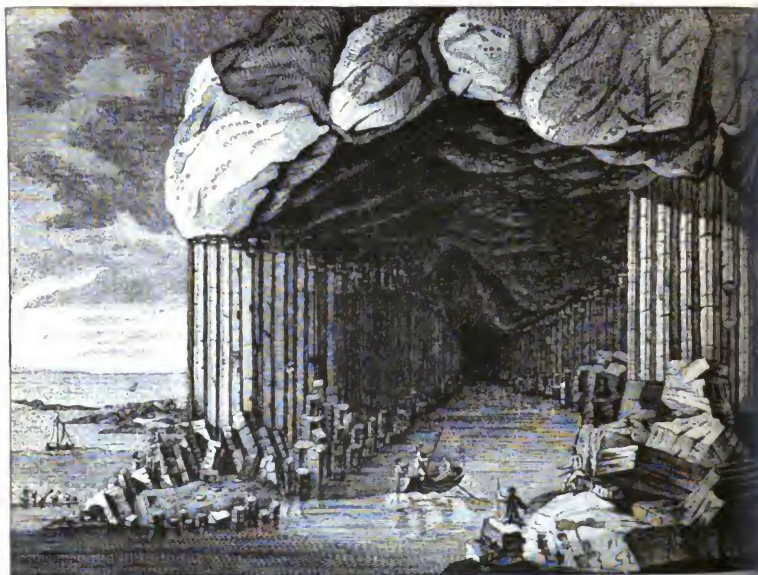


Isle of Boo-Sha-La and Bending Pillars opposite to it. According to Sir J. Banks.

columnar basalt—"what are the cathedrals or the palaces built by men? mere models or playthings, imitations as diminutive as his works will always be when compared with those of nature. Where is now the boast of the architect? regularity, the only part in which he fancied himself to exceed his mistress, Nature, is here found in her possession, and here it has been for ages undescribed. Is not this the school where the art was originally studied, and what has been added to this by the whole *Grecian* school? a capital to ornament the column of nature, of which they could execute only a model; and for that very capital they were obliged to a bush of *Acanthus*; how amply does Nature repay those who study her wonderful works!" He added in a note:—"Staffa is taken notice of by Buchanan, but in the slightest manner; and among the thousands who have navigated these seas none have paid the least attention to its grand and striking characteristic till this present year."

It will be noted that he has not yet seen Fingal's Cave, or even heard

of it. "With our minds full of such reflections we proceeded along the shore, treading upon another Giants' Causeway, every stone being regularly formed into a certain number of sides and angles, till in a short time we



Fingal's Cave in Staffa. According to Sir J. Banks.

arrived at the mouth of a cave, the most magnificent, I suppose, that has ever been described by travellers. The mind can hardly form an idea more magnificent than such a space, supported on each side by ranges of columns, and roofed by the bottoms of those which have been broken off in order to form it, between the angles of which a yellow stalagmitic matter has exuded, which serves to define the angles precisely, and at the same time vary the colour with a great deal of elegance; and to render it still more agreeable, the whole is lighted from without, so that the furthest extremity is very plainly seen from without, and the air within, being agitated by the flux and reflux of the tide, is perfectly dry and wholesome, free entirely from the damp vapours with which natural caverns in general abound."

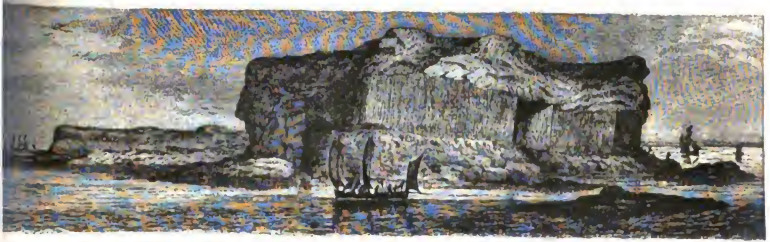
Apart from the strong terms of the opening sentence, and the very natural error in respect to the supposed stalagmitic matter, the description is sufficiently reasonable. "We asked the name of it. Said our guide,

The cave of Fiuhn. What is Fiuhn? said we. Fiuhn MacCoul, whom the translator of Ossian's works has called Fingal. How fortunate that in this case we should meet with the remembrance of that chief whose existence, as well as that of the epic poem, is almost doubted in England." This was of course a sad mistake. The cave of Fiuhn was the cave of Fuaim,—the "cave of sounds," as Mendelssohn was destined to perpetuate it. The error was almost instantly detected, and late as it is, at least such authoritative publications as charts and official maps ought to give the true name, even if it be too late to eradicate the unfortunate, but otherwise pardonable, error of the first English tourist. "Enough for the beauties of Staffa; I shall now proceed to describe it and its productions more philosophically."

This he proceeds to do in language and with measurements in all respects admirable. He also furnished Pennant with five sketches. They are of unequal merit. Two of them ought not to have been engraved. Two are capital: they are vigorous and accurate; good in drawing and picturesque in effect, they bear comparison with the absolutely perfect photographs that lie before me. In the "View of the erect columns near the Shag's Cave on the island of Staffa, taken from the sea," the draughts-

Cormorant's Cave.

Boat Cave.



Staffa from the South-South-West. According to Sir J. Banks, 1772.

man gave the entire breadth of the island from SSW. Standards of measurement are repeatedly introduced, and the sea is rightly represented as comparatively calm. So the "Isle of Boo-Sha-La, and bending pillars opposite to it" (reproduced above), deserves unstinted praise. It was a difficult subject, but here again a photograph of Clamshell Cave proves the moderation and fairness of the anonymous artist and engraver. "Fingal's Cave in Staffa" is a separate and inferior sketch. Loose rectangular blocks of horizontally stratified stone seem to have fallen from a roof which is formed by rounded masses of conglomerate. It contradicts the text. It could not therefore mislead an intelligent student. Indeed Faujas St. Fond, the French Academician, whose treatise, with its infelicitous engravings, was published in Paris in 1797 and in London in 1799, said :

"Sir J. Banks' draughtsman, very good and accurate in other respects, has substituted, probably to give greater effect to the cave, large masses



Interior of Fingal's Cave. Engraved for Mr. Cope Whitehouse.

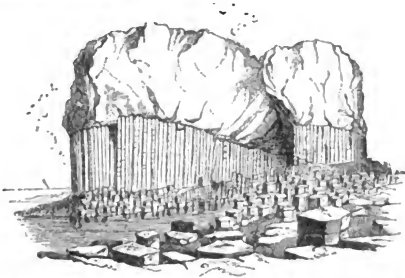
of stone irregularly piled on each other, on the right side of the kind of amphitheatre which serves as a basis to that part of the cave. But there is in reality nothing there except columns." St. Fond himself, however, committed a blunder for which there was no excuse. In the French text-books, even in the *Dictionnaire Universel* of La Rousse, the length of Fingal's Cave is given, on the authority of the folio edition of Panckoucke (Paris, 1831), at 45·47 mètres, or about 150 feet. Its length, according to Banks, was from the rock without 371 ft. 6 in.; from the pitch of the arch 250 ft. The sea-floor, as measured by Admiral Bedford, on the manuscript chart at the Admiralty, gives from east high-water point to the head, 288 ft.; span of arch to head, 212 ft.; height of arch above high water, 59 ft.; breadth of cave under arch, 33 ft.;

general depth to the head, 24 ft. These measurements differ, it is true, from those given by Banks:—

	ft.	in.
Length of the cave from the rock without,	371	6
Length from the pitch of the arch,	250	0
Breadth at the mouth,	53	7
Breadth at the further end,	20	0
Height of the arch at the mouth,	117	6
Height at the end,	70	0
Height of an outside pillar,	89	6
Height of one at the north-west corner,	54	0
Depth of water at the mouth,	18	0
Depth at the bottom,	9	11

We can readily see, however, that Banks wished to give the largest dimensions of the cave; and, as he had a right to do, he gives the maximum breadth and the depth into the recess, considerably above high-water mark. When I succeeded in Paris in getting at a copy of the original folio of Panckoucke, I found that he had simply visited Staffa by steamer. It was evident, therefore, that his figures were borrowed from

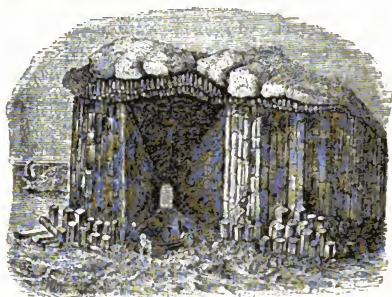
the 140 French feet of St. Fond. It will scarcely be believed that although St. Fond was a man of scientific rank, he actually took pains to claim superiority over Banks for his measurements: "All the dimensions were taken with the greatest exactness—with a piece of thread tape painted and waxed." He suggested that the fishing-line used by Banks had probably become wet and stretched. Fortunately he furnished a clue to his blunder by saying that his tape was exactly 100 French feet. Obviously he had forgotten to note the first length; for $100 + 100 + 40$ *pièds* are a little over 250 feet. In 1819 MacCulloch gave the full and elaborate results of repeated visits, which left, it would have seemed, little to learn and no room for doubt or error. He noted seven caves, on all sides of the island, and furnished standard information upon the subject. He expressed surprise at supposed "erratic" blocks of granite near the landing-place, which clearly might have been brought from Mull for architectural purposes as similar blocks to Iona. But he contributed a more serious error.



Columnar Basalt of Fingal's Cave, Staffa (MacCulloch). From the *Text-Book of Geology*, Dr. A. Geikie, 1882.

In a late and authoritative text-book of Geology, published by a house of high repute in 1882, there is an absurd caricature of Staffa, for which MacCulloch is responsible. He originally gave two pictures. This plate, published 1st June 1819, by Constable and Co., of Edinburgh, is signed: "J. MacCulloch delt., Chas. Heath sculpt.;" and entitled "Entrance of Fingal's Cave, Staffa." It does not stand alone as a caricature of Staffa. If five men in a geological paper set by the Royal Professor of Geology at the South Kensington schools were to draw five pictures which bore no more resemblance to each other than St. Paul's Cathedral to the London Docks, but which nevertheless were exact reproductions of Staffa in standard text-books, that eminent geologist might feel compelled to give them all the same high marks, although he himself well knew that each picture in turn was a flagrant violation of all the laws of nature which it was cited to prove, and he was engaged to teach. For example, there is a picture by Turner. It is quite as bad as it could be. It gives Fingal's Cave from within. The waves are dashing thirty feet

high into an archway of curved columnar basalt, and the setting sun shows that the cave points to the west and the open ocean. But curved columnar basalt is the only volcanic formation found in Staffa which does not occur in the excavation. It is in tuff, perpendicularly columnar, and bedded basalt. Looking out of the cave one sees Iona. The cave faces nearly due south. Yet Turner also painted a large and correct picture of Staffa which hangs in the Lennox Gallery, New York.



Fingalshöhle auf Staffa. From the *Geologie u. Petrefactenkunde* of Dr. Vogt, 1874.

Another student may have purchased the *Lehrbuch der Geologie und Petrefactenkunde* of Vogt. He finds a columnar hall or colonnade, which although vaguely attached in a somewhat deprecating fashion to nothing in particular on the right, and with a queer little promontory jutting out from nowhere at all on the left, is positive enough in its interior construction. It appears to be about 21 ft. high, 16 ft. wide, and 1000 ft. long. The sea must be very shallow; for the smallest wave would knock those columns into a pile of prisms. What a current, too, must suck through it; for all the *débris* has been washed out through the dim doorway at the other end. If this youth were of sceptical mind, and had heard of a German mode of evolving facts from inner consciousness, how could he fail to satisfy himself of its truth after consulting the latest French edition of Badin's *Grottes et Cavernes* (Paris: Hachette & Co.). Still dubious, he may have looked at a handsome edition of Sir Walter Scott, published in Edinburgh. This same picture did duty as a tail-piece at the very time when Turner was inventing his equally impossible structure for a frontispiece.

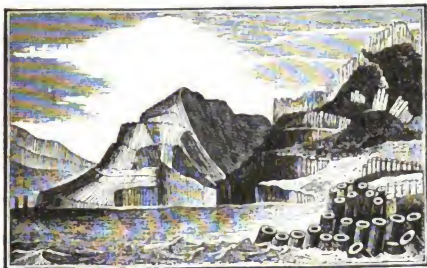
Undoubtedly it is bad enough that in "Geology," one of the science primers edited by Professors Huxley, Roscoe, and Balfour Stewart (1881), a barely passable resemblance to part of the island should be made to do duty for the whole; but the triumph of perverted ingenuity received the formal approval of Gideon Mantell and John Pye Smith. On their assurance Dr. Edward Hitchcock inserted in twenty-five editions the most ghastly

bit of unscientific illustration that ever figured in any work. Labelled "Fingal's Cave, Staffa," it shows no cave at all. The author, therefore, added the words "a chasm (in these columns)" to save himself from the



The Island of Staffa, with Fingal's Cave. From *Geology*,
Dr. A. Geikie, 1881.

pertinent questions of his students. Hitchcock gravely asserted, and Mantell and Smith indorsed the assertion, that "the following sketch will convey an idea of the situation of the cave," when this travesty, as far as it represents anything, is a reduced and disfigured copy of part of "the



Fingal's Cave, Staffa. From the *Elementary Geology* of
Dr. Hitchcock, 25th ed., 1854.

island of Boo-sha-la and Clamshell Cave," of Sir J. Banks, on the west side of Staffa. This picture "revised, enlarged, and adapted to the present advanced state of the science (1854), with an introductory notice by John Pye Smith, D.D., F.R.S., and F.G.S.," has probably gone to the melting-pot, but the author of its being, the parent cut, very little better, was actually used, in 1884, in an excellent work also emanating under

the regis of that prolific Government office which had already provided, in 1881 and 1882, two alternative sketches.

Each successive engraver improves away some feature, suppresses natural standards, converts blocks of basalt into frigates, casts the columns as round and hollow pipes, elevates precipices to the giddiest height, runs a causeway a thousand feet out from the island, squares, rounds, splits the roof, or takes it away altogether. These degrading exhibitions are at this present moment offered for sale, while both Fingal's and Clamshell Cave are correctly represented in a sixpenny guide-book of the Hebrides.

There is, so far as I am aware, nothing more inaccurate than this in literature. Sir John Mandeville taxes the credulity of his readers, Sindbad indulges in flights of imagination, upborne on scantily furnished pinions. Although we had, in 1772, a single series of accurate pictures (save two minor errors, both of which were corrected in the last century),



View from the North End of Iona looking North, by the Duke of Argyll.

we have now a widely differentiated and bastard progeny from these same pictures, impudently confronting the photographs, the lithographs and engravings from them, and the noble etching of Mr. Johnson.

The strangest thing about the whole matter is the indifference of Sir J. Banks himself. He must have known that the tourist expected to see something very different from the scene of magnificence which had rightly won his admiration and that of Pennant, as the rising sun shone on the infinite number of clustered columns which he thought had suggested the peristyle of the Grecian temple. "From my earliest days," wrote the companion of Mendelssohn, "I have confounded the Hebrides with the Hesperides; and if we did not find the oranges on the trees, they lay at least in the whisky toddy." It aroused "peculiar feelings" in the King of Saxony that he should be near and able to see with his own eyes that wonderful island whose basaltic rocks and Fingal's Cave had occupied his fancy even in his boyish years. Rightly expressing his admiration for the island, he vented the royal displeasure in a denunciation of those "imperfect and even bad

representations" which he had contemplated "with such earnest and longing desire," and which the geological text-books of England, France, and Germany, in 1874, 1881, 1882 and 1884 affectionately reproduce.

Yielding to no one in my admiration for Staffa, I thought to crown it



Relief Map of the Highlands of Scotland. From *La Terre*, by E. Réclus.

with honour by showing, in 1881, that the island deserved to rank among those fortresses which even in the time of Cæsar extended from the Syrian coast to Heligoland. When the Phœnicians found an islet too small for habitation, or when in more peaceful days there was less necessity for constant watchfulness, they shifted to the adjacent mainland. Mont St. Michel and St. Michael's Mount are still surmounted by the Christian churches which are founded upon the early temples of the

Galatians of the West. I therefore thought that in Staffa and Iona we might have something older than the settlement of the fifth century. A vessel leaves Oban, the acknowledged centre of all the commerce of the West Coast of Scotland, and in a few hours has carried its passengers across the mouth of the ancient inland route to Norway, and the open highway from the Isle of Man to Skye. The sight-seer returns, having seen within half an hour two points of the most dissimilar character, confronting one another at less than six miles, so far beyond any other points of interest that comparison is impossible. They are commonly treated as connected by an accident of Geography, as an apparent double-star which is in fact composed of two distinct suns wholly disconnected in space. But I thought that I saw a true *stella duplex*, and that once in history they had formed a political and social unit, and mutually offered an explanation of their *raisons d'être*.

When the Emperor Severus was dying at York the inhabitants of some western island were making enamels of a high order. If Iona became the seat of power in the Isles, it was because a sort of investiture took place, not wholly dissimilar to the rights exercised by the Oracle at Delphi, or the High Pontiff at Rome. Where did Dun-Staff-nage obtain its name or its coronation-stone? Who that is conversant with the powerful maritime empire of the Phoenicians, and the politics to which Aristotle awarded the palm among the constitutions of the ancient world, would hesitate to admit that refugees from Syria may have taken ship for remote colonies, as was done by the Huguenot and the Puritan? It trenches upon a dangerous line of research only because some have been greedy to swallow inferences as well as facts. But the practice of the British of antiquity was as perfect as their policy was wise. "The merchants of Tyre were the first to establish the system of factories or agencies, where they were able not only to dispose of their several cargoes to the best advantage, but to collect the produce of other lands so as to be ready for shipment on the arrival of their fleets." Iona is as well situated for such a purpose as Oban. Staffa is a natural fortress in the very centre of the great bay formed by Mull and the Treshnish Islands, and impregnable for defence. It seemed to me that the common explanation of the headship exercised by Iona was not in accordance with the ordinary law of traditional sovereignty. Iona must have been at least very near the centre of some recognised authority, awful in the majesty of unknown origin, superior ability, and alien race. Staffa was precisely the spot which a Tyrian or a Carthaginian would select for the reasons which had indicated the islands and headlands of the Mediterranean or the Atlantic.

This opinion would be greatly strengthened if it should appear that the caves of Staffa are not the work of the sea. Caves worn by the sea are due to the set of the currents, the force of the breakers, and the grinding of the shingle, which inevitably discover the weak places in the cliff, and leave caves as one of the results of their work, modified in

each case by the local conditions of the rock. These forces are conspicuously absent. Staffa is so completely embayed in Mull and Iona that

Treshnish Islands.



South-West End of Staffa. From *La Terre*, by E. Réclus.

only a very small portion even seems to face the Atlantic. There is no serious current sweeping into the bay. The spring-tides rise $11\frac{3}{4}$ feet, neaps 8 feet, and range $4\frac{1}{2}$ feet. There is a maelstrom to the south behind Colonsay, where "Corryvreckan's surges driven" make "the caldron of the spectral sea." The force of the breakers is relatively inconsiderable. They are the result of local disturbance, or the ground-swell and heaving of the sea after a south-west storm; the tuff is not undermined. The

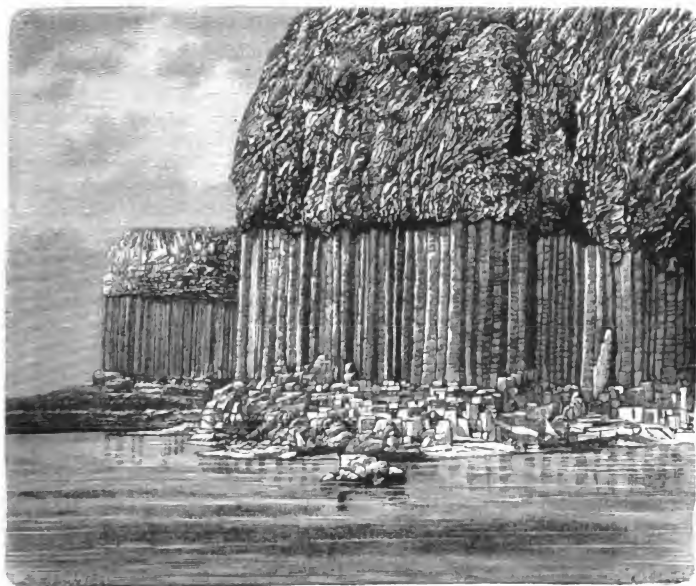
island has constituted for itself a sufficient protection in its foreshore. Seen in erroneous pictures, the perpendicular columns have given rise to the error of "an unknown profundity of depth;" but the basalt at the south-west end is over 50 feet above the sea-level. A spit of tuff prolongs under water a flat, rocky shore. There is a succession of shoals on the exposed side. The 20-fathom line is a mile distant, the 10-fathom line half a mile, with rocky heads, and 12, 15, and 9 feet of water. Not only must a wave have a depth of water equal to its semi-vibration, but the incompressibility of the fluid checks the undulation on a shelving coast, and diminishes it until the moment when what is left of it capsizes and plunges headlong up the shore, or strikes against some cliff. There is no shingle. The prismatic blocks of basalt are too refractory. The tuff is too soft. A cave is the result of a weak place. A trap-dyke may be more easily dislodged than softer homogeneous material. In any case, however, it is a simple mechanical problem.

Staffa has four caves of importance. Each requires separate consideration. The smallest is Boat Cave. It is well shown in the so-called "View of the south side of Staffa" in the recent excellent *Scenery of Scotland*. Its dimensions, as given by MacCulloch, correspond with the results of my observations (1885), and are confirmed by photographs. It is about 16 feet high, 12 feet broad, and 150 feet deep. It has been formed in a volcanic tuff underlying the columnar and bedded basalt. It is, however, said to "bear witness to the enormous erosive power of the Atlantic breakers" (*Scenery of Scotland*, p. 219). Now it follows from what has just been stated that every cave bears witness to the strength of the rock which forms the rest of the cliff, even more than to the disintegrating power of the sea. The sea attacks the entire face. It is defeated along a line of several hundred yards. It is here claimed that it penetrates for a breadth of four yards to a depth of fifty. One is struck by the extraordinary disproportion of breadth to depth. Boat Cave is a long opening, said MacCulloch, resembling the gallery of a mine. In a different situation it might seem conceivable that it was the result of fresh-water erosion, as the bed of a stream, but its parallel sides and rectangular section are in sharp contradiction to every known case of a sea-cave formed in tuff. The grotto of Capri is a fair example. The length of the Italian cave is perhaps double the breadth. Here the length is twelve times the breadth.

The horizontal floor and uniform depth of water are serious difficulties. A tuff cave formed in a cliff by marine action usually has an entrance a little higher than the water-line, where the action of the sea, aided by diurnal exposure from tidal flow and ebb, commences a disintegration which is carried on below the surface. The cavern gradually comes to resemble any other bay—with this difference, that it has a vaulted roof. As the entrance deepens the waves obtain freer access to the interior of the cavern, but they rush under the low brow of the arched doorway, leaving it untouched, and form a shelving shore in the heart of the soft

rock. The retreating waves carry out the *débris* falling from the roof, and this shingle deepens the erosion below the stratum agitated by the wind. Here these conditions are wholly wanting. A narrow channel, about 6 feet deep at mean high tide, leads to the mouth of Boat Cave, which opens upon a very shallow bay. A spit of tuff projects beyond the axis of the cave, which faces to the east of south.

The erosive power of the Atlantic breakers is accurately stated, as well as described with skilled rhetorical phrase, in the chapter (iii. p. 41) which treats of the sea and its work on the Scottish coast-line. The ascertained impact of storm-waves on the Outer Hebrides is 6083



Southern End of Staffa to the West of Fingal's Cave. From *La Terre*, by E. Réclus.

pounds to the square foot. The rate of waste along some parts of the Orkney and Shetland Islands is so rapid as to be distinctly appreciable within a human lifetime. But there has been no apparent change in Boat Cave within a century. Banks (1772) and MacCulloch (1819) depict it precisely as we see it in the latest photograph. Skerryvore lies between Staffa and the Atlantic. The most careful observations of the force of the breakers in this part of the British seas are those made during the progress of the erection of its lighthouse. The average results of these

experiments for five of the summer months, during the years 1843 and 1844, give to the breakers a force of 611 lbs. per square foot; and for six of the winter months of the same years 2086 lbs. per square foot, or thrice as great as in the summer months. The greatest result obtained was during the heavy westerly gale of 29th March 1845, when a pressure of 6083 lbs. per square foot was registered. This was a force of little short of three tons on every square foot of surface (Stevenson, *Trans. R. Soc. Edin.*, xvi. p. 25). Looking at the edges of the entrance to Boat Cave, it is inconceivable that this soft tuff has been exposed to the constant lashing of the Atlantic surges, or resisted during the storm of January 1836 a force which moved a mass of gneiss, containing 504 cubic feet, and estimated to be about forty-two tons in weight, a distance of five feet. In looking at the results of the wear-and-tear of the coast-line we are apt to assign too much importance to the action of the breakers, and too little to the less obtrusive but more constant influences of rains, springs, and frosts. The bedded basalt which covers Staffa practically defies sub-aërial disintegration. Hence the rate of erosion is easily measured by the difference between the sub-aërial and submarine rocks. But there is no difference: there is no erosion. These points might be further elaborated, but they are rather statements of fact to support a foregone conclusion, for no one can take the most cursory view of a photograph of this part of Staffa, and then look at a map, or, far better, a chart, without seeing that this so-called cavern not only does not bear witness to the enormous erosive power of the Atlantic breakers, but that it, with the adjacent shore, is completely protected from any perceptible waste.

I am not bound to say what made the cave. I may believe it to have been the lair of the sea-serpent, and yet be right thus far. Dr. Archibald Geikie makes a statement in this his latest book (*Scenery of Scotland*), which is capable of mathematical demonstration. I have shown that the natural forces at work in Staffa would not yield the result he obtains.

After all, Boat Cave might be an artificial excavation, formed to shelter from rain, sea, and foe a line of fishing-boats or galleys, and the error not be worth the trouble of correction. It is otherwise with the adjacent "Cave of Noise." It is thus described by Professor J. W. Judd: "The remarkable grotto known as Fingal's Cave has been formed in the midst of a lava stream. The thick vertical columns, which rise from beneath the level of the sea, are divided into joints, and have been broken away by the action of the sea; in this way a great cavern has been produced, the sides of which are formed by interlacing columns, while the roof is made up of smaller interlacing ones. The whole structure bears some resemblance to a Gothic cathedral, the sea finding access to its floor of broken columns."¹ This is an amplification of the words of Professor Boyd Dawkins, who describes it as hollowed out of columnar basalt. Curious, if true, that the sea which constructs a causeway out of columnar

¹ *Volcanoes*, p. 106; 1881.

basalt on the Irish coast should hollow a cave in it on the Scottish. Columnar basalt, except in dykes, shows no disposition to form a hollow. The basalt at the Giants' Causeway for the height of some hundreds of feet above the Chalk is quite amorphous, and caps the low promontories along the coast. When it is brought so low that more than one-half its thickness is immersed in the sea, the remainder projects above the water, and forms the well-known pier. The caves are in the great ochre bed or



Fingal's Cave. From a Photograph. Engraved for Mr. Cope Whitehouse.

indurated chalk. The only instances of caves in columnar basalt are the Cheese Cave in France, and a hollow on the shores of Alaska, of which I possess a unique photograph. Neither of these would help Professor Judd in maintaining a proposition which is directly opposed to law and fact. It is not the case that the floor is composed of broken columns. The submarine cave is in tuff. It therefore might be a marine erosion, provided it conformed to the other sequences of Nature.

But its breadth at the water-line is 33 feet and its length is 288 feet, of which 212 feet are under cover: hence the same irreconcilable proportion, as in Boat Cave. The sea obtains only indirect access. The axis of the cave points to the land, and that land the peak of Iona. Professor Judd omits to call attention to the hooded entrance of the cave. The point of this *tympanum* is 59 feet above high water. The general depth

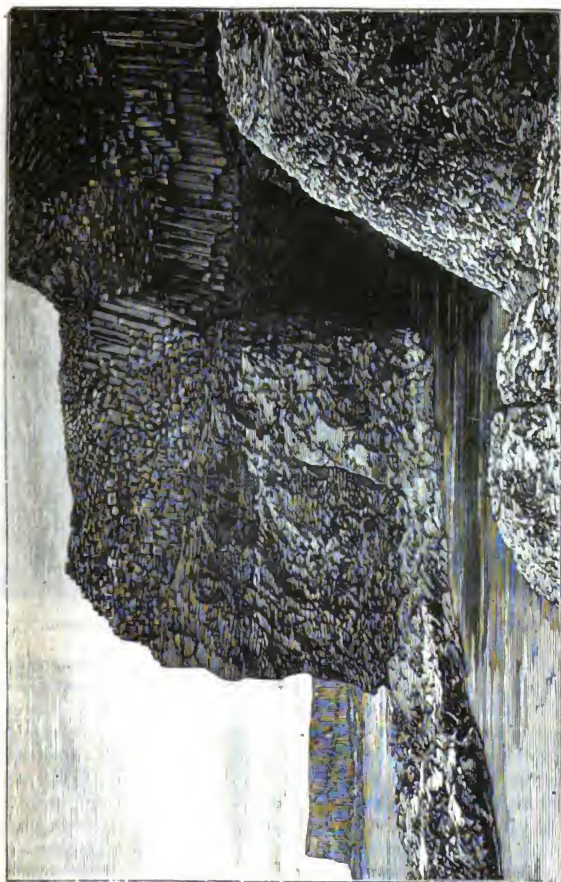
in the entire channel is only 24 feet. The edges are not abraded by the action of spray in countless ages, or as if battered with shingle mingled with flying foam. They are as sharp as the jambs of Boat Cave,—sharper than the wrought blocks on Dartmoor, which also bear no sign



Interior of Fingal's Cave looking towards Iona. Engraved for Mr. Cope Whitehouse.

of tool. The cave is clearly of human workmanship. It is wider above water-mark (in the columnar basalt) than below it (in the tuff), and a few poles stretched across would serve as davits to support the light galleys which their crews were accustomed to carry over the *Tarberts* of Mull and the mainland. A few floating baulks of timber lashed together would break the waves ten-cables' length away. The wave that, on the 29th of August 1884, drowned two tourists, was said to have been 14 feet high; but I was assured by an eye-witness that 2 feet was not far from the truth.

On the west of Boat Cave lies Cormorant's or Mackinnon's Cave. It is almost wholly in the tuff. It is 50 feet high, 40 feet broad, and 224



Scart or Cormorant's Cave. Engraved for Mr. Cope Whitehouse.

feet long. These measurements, by MacCulloch, are practically identical with the breadth of 42 feet, and length 227 feet, given by him for "Fin-gal's" Cave. All that has been said of the other two caves applies also to



Hooded Entrance to Cormorant's Cave. Engraved for Mr. Cope Whitehouse.

this one. It, too, has a natural breakwater, and a hooded doorway which rises into the columnar basalt. Is it within the range of argument to say that two tunnels of the same dimensions have been driven under different conditions by the same force? Clamshell Cave is a sudden interruption in curved columnar basalt, bent so as to form on one side a series of ribs not unlike an inside view of the timbers of a ship, while the opposite wall is formed by the ends of columns (see Fig. 4). It is 16 feet wide, and 130 feet long. It faces the east. There cannot have been any weak place here. It is peculiarly protected by the little conical island on the left, behind which it lies. It is worthy of notice that a canal has been deepened between this island and the mainland, and widened by a slice from the island, which, for a few yards, loses its natural conical shape. This channel would be an advantage if it were desired to bring a galley from the more exposed south side to the ordinary landing-place.

The caves of Staffa, therefore, seem to be improperly classed with caves worn by the sea, for the following reasons :—

The rarity of caves in Scotland is an established fact.

There are seven caves in Staffa.

They are on all sides of the island.

They are sudden interruptions of a shelving coast.

There is no erosion or excavation in the western exposed tuff cliff.

Two caves are on the eastern side, and face Mull.

Fingal's Cave, Boat Cave, and Cormorant's Cave are opposite to Iona.

Each cave is protected by a natural breakwater.

No cave has a south-western axis.

There is no excavation in the bedded basalt except above Fingal's Cave.

There is no yielding of roof in the columnar basalt above Boat Cave.

Columnar basalt under the action of the sea forms a causeway, not a cave.

There is a tympanum or hooded doorway to Cormorant's and Fingal's Cave.

Long sea caves cannot have the entrance higher than the interior.

The two larger perforations are in horizontally homogeneous but perpendicularly different rock.

The greatest width of Fingal's Cave is in the columnar basalt above the ordinary wash of the sea.

Fingal's Cave is in tuff, columnar, and bedded basalt.

Cormorant's Cave is in tuff and columnar basalt.

Boat Cave is in tuff.

Clamshell Cave is in curved columnar basalt.

The dimensions of these four caves show two distinct sizes.

The sea floors are rectangular.

The entrances in tuff and curved columnar basalt are rectangular.

The three southern caves, if erosions in tuff, should exhibit curved surfaces.

Narrow channels of uniform depth lead through shoal water to the end of Cormorant's and Fingal's Caves.

There are no corresponding crevices on the surface of the island.

The *débris* has entirely disappeared from the excavations.

The material taken away is about 150,000 cubic yards.

The columnar basalt is easily removed by human agency, but would not readily be reduced to shingle.

A force sufficient to pulverise the basalt would have destroyed the island, certainly the eastern wall of Fingal's Cave.

There is no bar or deposit of gravel in front of the caves.

The island of Staffa is protected by its own foreshore.

Staffa is in the centre of a circle almost closed by land.

The shoals between Iona and Back Beg break the Atlantic surges.

The tides meet to the south.

No billow ever bursts in the Cave of Fingal.

The limited force of the breakers is shown by the island itself in its different parts.

No breaker eighty feet high is possible.

Sheets of foam and spray have no penetrative force.

This list is by no means exhaustive, nor, if taken separately, would some of the arguments appear of great weight. They cover, however, all the points of importance which have been brought under my notice.

The actual number of caves made by the sea on the Scottish coast is relatively inconsiderable. The contact of sea and land extends along half a million of miles. Not more than a score of excavations could be named which attain to considerable dimensions; Staffa has four caves within a quarter of a mile. This fact alone should put the scientific student on the inquiry why this tiny islet exhibits a rare phenomenon with exceptional frequency. It has sometimes been suggested that the land has risen. What if it has?

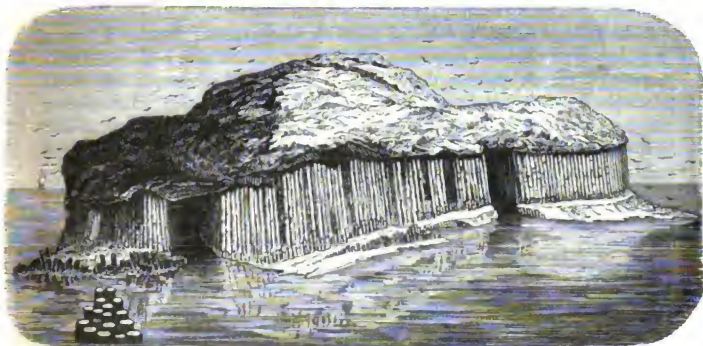
Dr. Woodward remarked on a photograph something that resembles a crevice in the bedded basalt above Fingal's Cave. Closer inspection and comparison with other photographs show that it is a groove or shallow depression such as would inevitably be made in the rough face of the cliff, if persons above were in the habit of lowering a rope or basket to those in the boat below.

The Duke of Argyll laid stress upon the unfitness of Fingal's Cave as a harbour. Mr. William Black has repeated the same objection. It would not require five minutes to shift a galley from any particular cave into an adjacent one on the leeward side. After a lapse of nearly two thousand years every trace of an artificial protection may have disappeared, yet the Phœnicians may have defended this entrance with the engineering skill which enabled Joppa and Carthage to carry on a world-wide commerce. No boat can live in Fingal's Cave during a south-west gale. How does this prove that it might not be worth while to spend less than two thousand pounds in making a place where a galley might lie facing Iona whenever the wind blew from any other quarter? The boat might be raised above the reach of waves of even unusual height. The entire excavation may once have been converted into a dock, and lined with timber.

If asked how the excavation was actually carried out, I should reply that the rock-hewn temples of Petra and Abu-Simbel were commenced at the top. The triangular mass of bedded basalt would be removed. Then an entrance would be made, and the drums of the columnar basalt taken out until the tuff was reached. The sea would not be permitted to enter the interior of the excavation until the floor had been lowered to a sufficient depth. It would be an easy task to deepen the channel outside leading through the rocks, which probably induced the selection of this particular spot. A most exaggerated opinion is current in regard to the labour required. So far from resembling a cathedral, the cost of a replica of the excavation would be less than that of many a flying buttress. All the caves of Staffa could be repeated for the price of a village church or a baron's tower. It must be remembered, however, that the burden of proof is on the geologists who assert that these excavations resemble the illustrations in their text-books, and are normal results of the contact of sea and land. It is not even necessary for me to prove that they are wrong in asserting that these caves are marine erosions. It is only necessary to show that there is a reasonable doubt, and to require them—as should have been done at the outset—to demonstrate with mathematical precision

how four rectangular tunnels came to be driven in homogeneous rock by waves which could not possibly reach the places said to have been eroded.

Let me point the moral by adding an illustration taken from *Our Earth and its Story*. It is the latest contribution to the series of pictures misrepresenting Staffa, and, I believe, was taken from *Unser Wissen von der Erde* (Fig. 92, p. 277), by Alfred Kirchhoff. It will doubtless



"Fingal's Cave," etc. Showing basalt taking a columnar form.

(From *Our Earth and its Story*, by permission of the publishers.)

achieve a wide circulation, especially as the other cuts in the same number of this deservedly popular series are remarkable for their accuracy and beauty.

REPORT TO COUNCIL.

BY HUGH ROBERT MILL, D.Sc., F.R.S.E., F.C.S.

The Society's Delegate to the British Association, 1887.

GENTLEMEN,—I have the honour to submit my Report as Delegate to the Manchester meeting of the British Association. This gathering exceeded in numbers any previous meeting of the Association, 3833 members and associates being present. A special feature was the unusually large muster of foreign men of science, who took a leading part in the business of the sections, and in the more social gatherings of the afternoons and evenings.

The opening meeting in the Free Trade Hall on August 31st was attended by as large and brilliant an assemblage as ever inaugurated the annual conference on Science; and although the somewhat special nature of Sir Henry Roscoe's address made it difficult for many of his hearers to

follow him throughout, it was listened to faithfully, and the fine sentiment from Lessing with which he closed called out enthusiastic applause.

The one remark of a general nature conveyed the hope that this meeting might result in the formation of an international conference for the advancement of Science, through which much good work might be done in the future. Should this suggestion be carried out no science will benefit more than Geography.

As Delegate from the Royal Scottish Geographical Society I was a member of the general committee of the Association, and took part in its meetings. The business done was mainly formal; but an important decision regarding the publication of Reports was ratified. It will now be possible to purchase separately all the more important reports and papers before the publication of the annual volume containing them. The addresses of presidents of sections are also available in the same way. It was resolved to approach the proprietor of Stonehenge, at the instance of the conference of delegates of Corresponding Societies, in order to induce him to pay attention to the state of the monoliths. The general committee authorised the expenditure of £1973 as grants to committees charged with various scientific researches. The importance of this part of the Association's work can hardly be over-estimated, and this year the sum voted is nearly half the value of the grant which the British Government provides annually for the "endowment" of research. The Geographical Section receives only £5, for the investigation of the depth of permanently frozen soil in polar regions; but thanks to the generous want of definition given to Geography, 22 out of the 45 grants may claim notice here. These are:—

Mathematics and Physics.—Ben Nevis Observatory, £150; Solar Radiation, £10; Differential Gravity and Meter, £10.

Geology.—Sea Beach near Bridlington, £20; Erosion of the Sea-Coasts, £15; Erratic Blocks, £10; Underground Water, £5; Volcanic Phenomena of Japan, £50; Volcanic Phenomena of Vesuvius, £20.

Biology.—Zoology and Botany of the West Indies, £100; Flora of Bahamas, £100; Marine Laboratory, Plymouth, £100; Migration of Birds, £30; Flora of China, £75; Naples Zoological Station, £100; Marine Station, Granton, £50; Peradeniya Botanical Station, £50.

Geography.—Depth of Frozen Soil, £5.

Mechanical Science.—Investigations of Estuaries by means of Models, £200.

Anthropology.—North-Western Tribes of Canada, £100; Prehistoric Race in the Greek Islands, £20; Anthropological Notes and Queries, £50.

Sir Frederick Bramwell was elected President for next year's meeting at Bath, and the invitation from Newcastle-upon-Tyne for the year 1889 was accepted.

Two Conferences of the Delegates of Corresponding Societies were held under the chairmanship of Professor Boyd Dawkins, both of which I attended. Thirty-three societies were represented, and most of the

delegates put in an appearance at the meetings. The report of the Corresponding Societies' Committee was read and adopted, and remarks were made by several gentlemen on the work done by their respective societies in regard to observations carried on in various departments of science. The importance of cataloguing erratic blocks and observing earth tremors was specially urged upon local societies. Mr. Ralph Richardson, F.R.S.E., suggested that the Erratic Blocks Committee should include Scotland as well as England and Wales in their reports, pointing out that a committee of the Royal Society of Edinburgh had in a series of lengthy reports laid up an immense store of data regarding Scottish boulders, which was freely available for tabulation and discussion. The general feeling of the Conference was at first that it might appear like an aspersion on the admirable and complete work of the Edinburgh Society if such a course were followed; but, after some discussion, it was determined to include the name of Scotland. With reference to local museums, Mr. Pullar mentioned that of the Perth Natural History Society as being singularly complete, clearly arranged, and serviceable. From the remarks of several delegates, it would appear that considerable advance has been made both in the contents and arrangement of local museums.

The Chairman called the special attention of Scottish delegates to the fact that, when the proprietors of ancient monuments in Scotland were willing to place these under the protection of the Act for Preservation, the Government Board in Edinburgh, through which the transfer must be made, placed various obstacles in the way. Considering the importance of an efficient system of inspection and of protecting prehistoric remains, it was extremely desirable that this should be simplified as much as possible. I have therefore to suggest that you should inquire into this, and take any action you may see fit, as it appears to me precisely one of those cases in which the intervention of your Society would be justifiable and efficacious.

In addition to the fields of research already covered by local societies, I suggested that in some cases good work might be done in the observation of temperature in rivers and lakes in connection with a committee of Section A,¹ which was appointed to consider this matter on my proposal.

Considerable dissatisfaction was expressed at the sectional President's addresses taking place at the same time, the only case of mutual accommodation being, as usual, that of Sections A and B. As the President's address has, as a rule, no bearing on the papers read to the meetings, it would appear easy to arrange for it to be delivered on some day and at some hour which would not clash with other sections, and this without in any way impeding the ordinary business. Another matter to which I think it well to direct your attention, is the want of system still pre-

¹ Consisting of Mr. J. Murray (Secretary), Dr. A. Buchan, Professor Chrystal, Mr. J. Y. Buchanan, Rev. C. J. Steward, Hon. Ralph Abercromby, Mr. D. Cunningham, Mr. Isaac Roberts, and Dr. H. R. Mill.

valent in conducting the sectional proceedings. Both my predecessors have referred to this in the case of Section E; but the evil is universal. The long sitting, from eleven to three, and the impossibility of judging at what time a given paper will be taken, are productive of much dissatisfaction and annoyance. Only people of very great importance can command an audience in the section rooms between one and two o'clock; and there was hardly a day in any section on which the papers coming late on the list could be read properly, or discussed at any length. This was felt to be unjust, particularly by foreign members, who regarded the discussion of papers as the most important purpose of the Association. Some simple arrangements would greatly improve matters, while additional system in the work of the sectional secretaries and firmness on the part of the chairman would remove all cause of complaint. As a rule, half an hour is ample for committee work. Let the committee meet as usual at 10; the section at 10.30, and sit until 12.45; adjourn for lunch until 1.30, and remain at work until 3.30. This would ensure a more uniform attendance of members, and greater freshness in the speakers; it would also prevent the undignified devouring of sandwiches by the chairman while papers are being read. Again, if the secretaries were to assign the time for each paper, and the chairman would see that it was adhered to, and also limit critical remarks to ten or five minutes, according to the hour and the state of business, there would be much greater satisfaction for all concerned. The arrangements for garden parties, conversaziones, and excursions were, as they have been for many years, much more perfect than those for the scientific meetings.

The Manchester meeting was one of more than usual interest to geographers, for, besides a number of valuable papers read to Section E, there were many bearing directly upon the subject submitted to other sections. To those which related to Geography in its geological, biological, and anthropological aspects, I shall not refer; but two papers claim special attention—one read to Section A, the other to Section G. The former, by Professor E. Hull, F.R.S., discussed the effect of continental land in altering the level of adjacent oceans. Of the enormous magnitude of this effect, I may venture to say no geographer has hitherto had any idea. The author's abstract will be printed as a note in the *Magazine*, and to it I refer for details, merely observing that if his calculations are correct the height of the Bolivian Andes above the true mean sea-level is more than 2000 feet greater than that generally assumed. Our notions of the relief of the earth as a whole must be greatly modified when we cease to view the ocean-surface as part of a sphere concentric with the lithosphere.

In the Section of Mechanical Science, Professor Osborne Reynolds showed how in a flat-bottomed estuary the action of tides, as determined by the form of the banks, would result in the formation of the shoals and sand-banks which actually occur. A most ingenious model of the Mersey, in which mimic tides of short period were kept up, showed the actual

processes of growth by which it is most likely that river-entrance assumed its present form. An abstract of this paper, describing the successful application of laboratory experiments to explain the process of natural geographical change, will be printed in the *Magazine*.

Sir Francis de Winton's evening lecture on exploration in Central Africa was a model of what a popular lecture should be. He handled his familiar theme with a systematic clearness and quiet enthusiasm which secured the sympathy and unfaltering interest of his large audience.

I must now, following the example of former delegates, give in some detail an account of the doings of geographers at home in Section E. The officers of the section were the following:—

President.—Colonel Sir Charles Warren, R.E., G.C.M.G., F.R.S.

Vice-Presidents.—H. W. Bates, F.R.S.; John Rae, M.D., LL.D., F.R.S.; Henry Lee; Admiral Sir Erasmus Ommanney, C.B., F.R.S.; General Sir H. E. L. Thuillier, R.A., C.S.I., F.R.S.; General J. T. Walker, R.E., C.B., LL.D., F.R.S.; Colonel Sir C. W. Wilson, R.E., K.C.B., K.C.M.G., D.C.L., F.R.S.

Secretaries.—Rev. L. C. Casartelli, M.A., Ph.D.; J. S. Keltie; H. J. Mackinder, M.A.; E. G. Ravenstein (*Recorder*).

Committee.—Dr. Ginsburg; Colonel Holdich, R.E.; J. Arthur Hutton; Professor Libbey; Hugh Robert Mill, D.Sc., F.R.S.E.; E. Delmar Morgan; Dr. G. Neumayer; Lieut.-Colonel Sir R. L. Playfair, K.C.M.G.; Josiah Pierce; Sir Rawson W. Rawson, C.B., K.C.M.G.; Trelawney W. Saunders; Eli Sowerbutts; Rev. S. Alfred Steinthal; Rev. Canon Tristram, D.D., LL.D., F.R.S.; Coutts Trotter; M. van Eetvelde; Sir Harry Verney; Captain Verney, R.N.; Rev. Thomas Wakefield; Professor A. W. Ward; Cope Whitehouse, M.A.; Colonel Sir Francis de Winton, K.C.M.G.; Dr. Ludwig Wolf.

Delegate.—T. Cushing.

The Section held four meetings, and, besides the President's address, thirty-five papers and reports were presented; but several of these were hurried over in a manner which took away much of their value.

Following is a complete statement of the daily proceedings:—

Thursday, September 1.

The President's Address.

1. *Dr. Ludwig Wolf*.—Exploration on the Upper Kassai and the Sankuru.
2. *Captain Coquilhat*.—The Bangala.
3. *Lieut. Le Marinel*.—The Congo below Stanley Pool.
4. *R. C. Phillips*.—The Lower Congo,—a Sociological Study.
5. *R. E. Dennett*.—A Visit to Diego Cão's Padrão, at the mouth of the Congo.
6. *Dr. A. Oppler*.—On Acclimatisation.

Friday, September 2:—

1. *Cope Whitehouse, M.A.*.—The Raiyan Basin.

2. *Colonel Ardagh, R.E., C.B.*—The Feasibility of the Raiyan Reservoir.
3. *Captain Conyers Surtees.*—The Desert from Dahshur to Aix Raiyan.
4. *Captain R. H. Brown, R.E.*—The Bahr Yusuf.
5. *E. A. Floyer.*—Between the Nile and the Red Sea.
6. *W. Brindley.*—A Visit to the Porphyry Quarries of Gebel Dukhan.
7. *A. B. Wylde.*—On the Red Sea Trade.
8. *Captain C. E. Haynes.*—Matabele Land and the Country between the Zambesi and Limpopo.
9. *Major Sir Herbert Perrott.*—A Note on Houghton, the African Traveller.
10. *John Forrest.*—Western Australia.
11. Second Report of a Committee for inquiring into the depth of the permanently frozen soil in the Polar Regions.

Monday, September 5 :—

1. *Professor Boyd Dawkins.*—The beginning of the Geography of Great Britain.
2. Report of the Committee on the Study of Geography at Oxford and Cambridge.
3. *H. J. Mackinder.*—Geography at the Universities.
4. *G. Skelton Streeter.*—The Ruby Mines of Burma.
5. *J. M. Carthy.*—Siam.
6. *W. J. Stearns.*—An Exploration of the Rio Doce, Brazil.
7. *Professor Libbey.*—On South-Eastern Alaska.

Tuesday, September 6 :—

1. Report of a Committee on a Bathy-Hypsographical Map of the British Islands and the Surrounding Seas.
2. *S. H. Wilkinson, M.A.*—On some Defects of the Ordnance Survey Maps.
3. *Colonel Sir Charles Wilson.*—On the Utilisation of the Ordnance Survey.
4. *Josiah Pierce, jun.*—On the United States Geographical and Geological Survey.
5. *H. R. Mill, D.Sc.*—On a Bathy-Orographical Map of Scotland.
6. *E. G. Ravenstein.*—A Plea for the Meter.
7. *Sir Erasmus Ommanney.*—Report of a Committee on Antarctic Research.
8. *A. R. Colquhoun.*—Formosa.
9. *John Yeats, LL.D.*—On the Study of the Natural Divisions of the Earth, rather than the National ones, as the Scientific Basis of Commercial Geography.
10. *J. J. Cardwell.*—Realistic Teaching in Geography.
11. *A. Park.*—The Teaching of Geography in the Elementary Schools of England.

The President's Address dealt with the importance of studying Geo-

graphy in its wider aspects, and with the best method of presenting its facts to children. In all he said on this subject Sir Charles Warren closely agrees with Dr. A. Geikie's views, as expressed in his *Teaching of Geography*. The latter part of the address is of peculiar value, enforcing as it does the necessity for geographical knowledge amongst statesmen and politicians, and proving, by many examples, what troubles have arisen through ignorance or neglect of geographical principles in fixing boundaries between neighbouring States.

The whole of Thursday, September 1, was, after the Address, occupied with Africa, chiefly with the region of the Congo; and the papers were followed by a very lively discussion. This turned chiefly on the adaptability of the Congo district for European settlements, and statements of the most contradictory nature were made. All that could be gathered from a review of the debate is that in some parts of the vast Congo lands Europeans can, with suitable precautions, live securely; but in other parts, and everywhere without special care, the climate is terribly fatal to white settlers.

Egypt and the Red Sea engrossed most attention on Friday, the paper of the day being that by Mr. Cope Whitehouse on the Raiyan Basin. Mr. Whitehouse has long cherished a scheme, which most people have viewed as chimerical, to regulate the flow of the Nile by storing up a supply of water during floods, and allowing it to return to the river in the dry season. Now, armed with complete surveys and statistics, and backed up by military engineers of standing, he proves the practicability of his project. He shows how, with an expenditure of a million pounds, two and a half million acres of waste land on the Nile delta can be reclaimed, and a revenue of two millions sterling become available every year. Papers on the trade of the Red Sea and the porphyry quarries of Gebel Dukhan appear to promise better things for Egypt and the Sudan in the future; and the general opinion expressed during a long discussion was that this country, hitherto so unfortunate, might soon by wise treatment become not only self-supporting, but a valuable possession for any European power.

Captain Haynes gave a favourable account of Metabele Land in South Africa as a field for colonisation; it has a good climate and plenty of arable land on the high ground, as well as gold mines.

The Second Report of the Committee for inquiring into the Depth of Permanently Frozen Ground in the Polar Regions presents some valuable data from York Factory, in 57° N. lat., where the maximum penetration of frost was found to be 102 inches. The committee was reappointed, and its further reports will be looked for with interest.

Very important work was got through on Monday. The scope and teaching of Geography were under debate for several hours, and provoked some admirable speeches. Professor Boyd Dawkins sketched the geological geography of Great Britain in the Archæan and Silurian periods, pointing out the changes in position of the coast-line of the old continent of Archæa.

He complained that hitherto geographers had greatly neglected this department of their science ; a statement which reference to the first two volumes of the *Scottish Geographical Magazine* would easily confute. Mr. H. J. Mackinder, the newly appointed Reader in Geography at Oxford, protested against such a purely geological paper being read to the section. Geography, he said, owed much to the results of Geology, nothing to its methods.

Mr. E. G. Ravenstein read the Report of the Committee on the Study of Geography at Oxford and Cambridge, which has completed its labours successfully, and secured adequate recognition of Geography as a science at the two great English universities. Mr. Mackinder followed with a clear and definite statement of his views on the teaching of Geography in the universities. He would give two courses of lectures, one on the principles of Geography, the other on the Geography of a special region. In the first course the methods and principles of geographical observation, reasoning, and exposition would be laid down ; and the fundamental facts of physiography described from the geographical standpoint. The discussion turned largely, as might be expected, on the relation of Geography to Geology and other sciences, and doubts were expressed as to whether the newly appointed Reader could carry out his scheme of teaching. To this Mr. Mackinder replied that the practicability of his methods had already been proved in the course of a series of successful University Extension lectures.

The remainder of this sitting was occupied with papers of the usual special type, which gave little opportunity for difference of opinion.

It was determined to take the remaining eleven papers on Tuesday, a decision which was to be regretted, as the greater number were so hastily run through as to leave it an open question whether it would not have been better for their authors to have withdrawn them altogether. Abundant time was devoted to the series of dissertations and discussions on maps, and the readers of the first five papers had no cause for complaint. The Committee on a Bathy-Hypsographical Map of the British Islands and Surrounding Seas reported on their work. It has been resolved that the land and sea be contoured at equal intervals, as referred to the Ordnance datum level, and that colour be used to bring out the spaces between the contour-lines. A number of specimen maps of the Medway and the Linnhe Loch districts were shown coloured according to different principles, the most effective being that in which the colours of the rainbow were employed in their natural order. Captain S. H. Wilkinson pointed out some defects of the Ordnance Survey Maps in a paper which occupied three-quarters of an hour, but was summarised in three lines :

"The Ordnance Survey does not give us detailed maps of Great Britain on scales reduced from 1 : 63,000, which are much wanted.

"The representation of the ground in both the 1-inch and the 6-inch maps is inadequate."

The discussion on this paper was extremely animated, many omis-

sions of the Survey being pointed out by other speakers. Sir Charles Wilson, in defending the work, said that the maps in future would be contoured below sea-level, but he did not reply to a question as to the delineation of deep rock basins filled with fresh water. He vindicated the Ordnance Survey as to mathematical accuracy and correct publication, showing that it compared favourably with the real work, though perhaps not with the artistic finish, of the maps of any Continental government; but he complained that in every attempt at improved methods or increased efficiency the Survey was checked by the false economical views of the Treasury, or the unreasonableness of the House of Commons.

Mr. Trelawney Saunders pointed out that, after all, not the surveyors, but the people of Great Britain, who complained of the maps, were to blame for all defects. Let them move Parliament, and any reform could be carried out.

Sir Charles Wilson then gave a short account of the origin of the Ordnance Survey in the year 1747, at Fort Augustus, when military roads were being constructed through the Highlands, and of its subsequent progress. He enlarged on the value of the cadastral survey on the scale of 25 inches to a mile, as applied to land legislation in Ireland.

The Geographical and Geological Surveys of the United States were described by Mr. Josiah Pierce, junr.; and other papers of greater or less importance were brought forward.

Admiral Sir Erasmus Ommanney, in the five minutes allotted to him, gave a brief and hurried summary of the report of the Antarctic Committee, but no discussion on it was allowed. The importance of Antarctic research from the points of scientific geography, meteorology, and general physics is difficult to overrate, and has certainly been greatly underestimated at the Manchester meeting. A detailed statement of the present position of the question will be given in the *Magazine*.

It is impossible to give in a few words a clear idea of the advances of Geography described in the sittings of Section E. The growing difficulty of defining Geography, and the increasing necessity of finding some dividing line from Geology especially, were often expressed. The value of the map as the basis of Geographical teaching was more fully recognised, and the necessity of cartographical reform so long felt seems at last to be resulting in practical improvements. Africa still claimed most attention; but more prominence was given to questions of economic and social interest than to exploration of new ground. The popularity of Section E is great, because it is not sharply cut off from A, C, D, F, G, and H, but forms a sort of common ground where specialists may meet and talk without special knowledge to boast of, or peculiar ignorance to make them ashamed.

The Hand-book to Manchester, published by the Association, unfortunately presents a sorry contrast both in bulk and quality to the Birmingham Hand-book of last year. The information given regarding the city and its surroundings is scant; and some of the writers are apparently

much more familiar with what they describe than with how to describe it. It would be unwise to put the book in the hands of a foreigner who desires to learn to speak English grammatically.

If the weather during the Association Meeting was inclement, it served only to bring out the careful forethought of the Local Committee who had planned so well for the comfort and convenience of the visitors. The hospitality of the Manchester people was worthy of the occasion; and the entertainments in the Royal Jubilee Exhibition, the Town Hall, Peel Park, and elsewhere, were carried through with great success. The excursions also on Saturday and Thursday were in most cases well attended, and thoroughly appreciated.

CURRENTS, ICE, WINDS, ETC., OF ICELAND.¹

It is well known to all mariners of the northern seas how difficult and dangerous it is to navigate the waters contiguous to the shores of Iceland, and that the difficulties and dangers are due to the insufficient knowledge they possess as to the hydrographic relations; to the want of detailed maps and technical directions for navigation; to the peculiar magnetic conditions, and the conditions affecting the currents and ice, which are not less peculiar; to the violent storms, thick foggy weather, long nights, and the absence of lighthouses on the shores. Setting aside certain short notices, there appear to be only two publications of recent times which deal with this subject, viz., Lieutenant C. F. Wandel's *Bemærkninger til Beseilingen af Islands Kyster* and Thoroddsen's *Den Grönländska Drifisen vid Island*. The former contains the results of observations and experiences affecting the currents and tides, the fogs and weather, during a three years' cruise in Icelandic waters; the latter treats of the ice which visits the island nearly every year, and is based upon information afforded by native writers during a period of nearly 700 years, going back to the beginning of the thirteenth century.

Currents and Tides.—The tides make a complete circuit of the island, the flood-tide following the sun, the ebb going in the opposite direction. On the west coast the flood-tide proceeds northwards, entering all the fjords on their southern side, and emerging from them on their northern side. The ebb-tide flows southwards, entering the northern side of the fjords and coming out along their southern side. The flood-tide then passes in succession along the north coast eastwards, the east coast southwards, and the south coast westwards. The ebb-tide of course circuits the island in the corresponding opposite directions. The initiation of ebb and flood does not take place off Iceland with the regularity which it displays off the English coasts, for instance. This seems to be partly

¹ Excerpted and abridged from *Annalen der Hydrographie*, Heft 7, 1837.

due to the isolated position of the island in the midst of a wide ocean, where its situation exposes it more freely to storms and bad weather, and partly to its extent and its high mountains, which form a sharp meteorological line of demarcation, so sharp that an easterly storm can rage on the south coast contemporaneously with a westerly storm on the north coast. Owing to the influence of the constant oceanic currents which sweep round the northern shores of Iceland, the flood-tide is generally much more powerful than the ebb-tide. The ebb-tide indeed sometimes fails to appear at all, especially when south and south-west winds have been constant for any length of time. On the east coast the tides are considerably weaker than on the west coast; whereas the difference between high and low water on the west coast amounts to 16 feet, on the east coast it rarely exceeds $7\frac{1}{2}$ feet. The shores of Iceland are, so far as is yet known, washed by two constant oceanic currents. (1) A warm Atlantic current flows northwards along the west coast, and then, turning eastwards, skirts the north coast. This is confined on the west and north by the cold Polar current that runs along the east side of Greenland, and sends off (2) a branch which washes the eastern shore of Iceland. It is not known how far the Polar current is distant from the west coast of Iceland; but a cold current has been observed 85 miles north of North Cape. The warm Atlantic current meets the branch of the cold Polar current, coming from the north-east, about the longitude of Melrakkasletta. It then bends first north, then west, and finally meets the main Polar current off the east of Greenland. Meanwhile the Iceland branch of the Polar current passes down the east coast, then along the south coast, getting gradually narrower and narrower, and eventually disappears in Faxa Bay. On the east and south it is limited by the warm Atlantic current which flows between Iceland and Norway. Being bordered on each side by a belt of warmer water, this Polar current seldom brings down ice; it is, in fact, only a superficial current, whose breadth continually changes. The temperature of its water, even when taken at short intervals, showed great and rapid fluctuations. The existence of the current, 70 to 90 miles from land, becomes suddenly apparent by a fall of 3° to 5° in the temperature. This fall in temperature may also, perhaps, be partly attributed to the fact that numerous rivers discharge their icy cold waters into the sea on the east and south sides of the island. Thus the permanent oceanic currents coincide in direction with the tidal currents, and so justify the saying of the Icelanders that their island is always girdled with a strong current flowing round it parallel to the sun's course. Almost next to nothing is known about the currents on the east and south coasts.

Ice and Weather.—The ice which gathers round the coasts of Iceland comes both from Greenland and from Spitzbergen, generally from the former. This always appears first, and consists of large sheets, fused together, often to a thickness of 30 feet or more. The ice which comes

from Spitzbergen mostly has the form of icebergs. Both kinds of ice make their appearance on the north-west coast, near North Cape, and are carried thence by the prevailing currents, the icebergs for the most part going south with the Polar stream, whilst the pack-ice moves eastwards along the north coast with the warm Atlantic current. When the ice appears early in the year—January or February—it goes away early, and proves but little detrimental to vegetation and to navigation. If it comes later than March, the coast frequently remains ice-bound nearly all through the summer, not getting free until towards the end of August. During the months of September, November, and December the shores of Iceland are nearly always free from ice; it has never been seen in October. Ice which has entered the bays is sometimes prevented by the headlands from coming out again. If then the north-east wind sets in, the ice gets wedged in so tightly that it can only be liberated again after a long interval by the combined action of wind and currents. During the time that ice is drifting along the shores the weather is always very unsettled and stormy—rain, mist, and snow prevailing. But once the ice has got set fast, the weather generally becomes more constant and quieter, with sharp frosts. North winds are almost always attended with fog; and the east coast is more subject to fogs than the north coast. And although all winds alike bring fogs with them, this is especially the case with the west wind; and these last are the prevailing winds. In the year 1874 there were 222 days on which the wind blew from the west. Moreover, west winds depress the fog downwards, so that it clings close to the earth, whereas with an east wind a strip of open sea-way, half a mile wide, is generally left between the fog and the shore. This holds good of the northern part of the east coast; but further south, circumstances change again: west and south-west winds bring fair weather, whilst winds from the sea bring rain and fog. On the south coast, fog is more seldom seen, and on the west coast hardly ever at all. The barometer is a less reliable indicator of the weather in Iceland than in other places. This is partly owing to the high mountains; for whilst in one fjord there may not be a breath of wind stirring, in another immediately contiguous to it a fresh breeze may be blowing, without the barometer indicating the least difference in the two fjords. Between the barometrical reading within a fjord and that in the open sea adjacent there generally exists a difference of one to two *mm*. The summits of the mountains, however, furnish some indication of impending changes in the atmospheric conditions. When they are entirely free from clouds, or only girdled by loose light cloud-flocks, calm and good weather may be expected; but if their summits are closely enveloped in dense masses of cloud, the streamers of which hang down the mountain sides, it is a premonition that bad weather is brewing. All round the coasts of Iceland it may be taken as a general rule that the wind increases as the water rises, and that the maximum height of the tide is higher in the evening than in the morning. The most favourable

period for navigating the coastal waters of the island is from 1st April to 15th October; but navigation here is at all times attended with considerable danger.

GEOGRAPHICAL NOTES.

EUROPE.

Population of Belgium.—On the 31st of December 1886 the total population of Belgium was 5,909,975. As the area of the kingdom is 11,370 square miles, the density of the population amounts to 519·8 persons to the square mile. From the establishment of the kingdom in 1831, when it had a population of 3,785,000, the number of its inhabitants rose to 4,073,000 in 1840; 4,426,202 in 1850; 4,731,996 in 1860; 5,088,000 in 1870; and 5,520,009 in 1880.—*Le Mouv. Géogr.*, 14th August 1887.

The Corinth Canal and Lake Copais.—Mr. Francis Carew, of the British Legation at Athens, in his report) *Annual Series*, 1887, No. 194) on the finances of Greece, remarks that “it may not be out of place to allude to two great works, one of which is on the highroad to completion, and the other of which will shortly be commenced. The first of these is the piercing of the Isthmus of Corinth, and the other the draining of the marshy district round Lake Copais (Lake Topolias), both of which undertakings should largely contribute in various degrees to the welfare of the country. The piercing of the Isthmus of Corinth, which may be justly regarded as one of the great engineering triumphs of the century, was commenced in 1882, and, according to the original contract, should have been completed in the spring of next year. Owing, however, to unforeseen difficulties which have presented themselves, its final completion will now be deferred to a later period. The main difficulties in its construction are, however, now surmounted, and the opening of the canal to general traffic is only a question of time. Although Austria is the country which will reap the largest benefit from it, the advantages which it will confer on the Greek coasting trade are very considerable, and Greek commerce in general will doubtless thereby acquire an additional stimulus. The draining of Lake Copais will effect the reclamation of about 27,000 acres of most valuable land. It is about to be undertaken by an English company, who are on the point of taking it over from the original French company; and, whatever may be its results as a financial operation, the advantages of the ultimate addition to this part of the country of such a large extent of valuable soil, with its accumulated fertility of hundreds of years, cannot be doubted.

ASIA.

Russian Expedition to Transcaspiæ and North Khorasan.—At the instigation of Prince Dondukoff-Korsakoff, Governor of the Caucasus provinces, and other high officials of the Russian empire, an expedition was planned in 1885 for the exploration of the newly conquered territory beyond the Caspian. The objects for which the expedition was organised were—(1) to study the general physical geography of the south-west portion of the former Aral-Caspian basin, and the mountain systems which belong to it; (2) to investigate the general geology of the region indicated, as well as to examine what resources (such as salt, naphtha, sulphur) it contained, which might eventually prove to be of commercial value;

(3) to study the fauna and flora. Dr. G. Radde, Director of the Caucasian Museum and Public Library at Tiflis, was selected as leader of the undertaking, and took charge of the botanical work; and he was assisted by Dr. A. Walter (in the place of M. M. Smirnof), zoologist, and M. A. M. Konshin, mining engineer, who, since the year 1881, had been labouring in pursuit of his calling in the regions to be studied, and was well acquainted with them, having travelled over them in nearly every direction. A preliminary account of the results of this important expedition is published in the last two issues (Nos. 8 and 9) of vol. xxx. of *Petermann's Mittheilungen*. The labours of the gentlemen concerned are described by each in turn. After a brief introduction by Dr. Radde, M. Konshin treats at considerable length of the geology, dividing his paper into three parts, of which the titles are—I. The Mineral Wealth of Transcaspia; II. Geologico-Orographical Account of the Mountains and Cultivated Tracts of Transcaspia; III. The Deserts of Transcaspia and the Ancient Bed of the Amudaria. The concluding portion of the report consists of Dr. Radde and M. Walter's account of the zoological and botanical results, together with notices of the routes and general remarks on the physical geography. An excellent map accompanies the report.

Earthquake at Vernoe.—During the month of June the town of Vernoe, a place of about 17,000 inhabitants, situated in Central Asia, in the Russian province of Semirietshensk, was visited by several earthquake shocks. The first tremor was noticed at half-past five in the morning of June 9th; but although it awoke everybody, it was only of a trifling nature. A quarter-of-an-hour later this was followed by the principal shock, which lasted from two to three minutes, and was attended with much more serious consequences. Of the 2500 dwellings which the town contained, 1700 were thrown down, killing more than 200 persons. All the surrounding district felt the effects of the concussion. Numerous crevices were made in the mountain sides, and at their foot, some of these last being filled with hot water. The total number of persons who perished is estimated to have exceeded 800. Other shocks, but less severe, occurred on the 21st, 22d, and 26th of June. A scientific expedition under M. Mutchketoff, Professor of the School of Mines at St. Petersburg, is about to proceed to Vernoe, for the purpose of studying the phenomena and results of the earthquake.—*Le Mouv. Géog.*, 14th August 1887.

Railway in China.—The Imperial Council of China have at last authorised the construction of a double railway from Tien-tsin to Taku, a distance of forty-five miles. The line will not cost much, as the country to be traversed is absolutely flat. The contractors hope in time to obtain a concession for carrying the line to the capital of the empire, Peking, a distance of $74\frac{1}{2}$ miles further, though there the cost of construction would be greater owing to the numerous canals that would have to be crossed.—*Annals de l'Extrême Orient*, September 1887.

Mindanao (Philippines).—This island is the second of the group included in the Philippine Archipelago. It was discovered by Legazpi, and lies between $9^{\circ} 49' 30''$ and $5^{\circ} 35'$ north latitude, and $121^{\circ} 53' 45''$ and $127^{\circ} 5' 15''$ east longitude, and has a total superficies of 34,250 square miles. Its extensive coasts are washed by the seas of Mindoro, Celebes, and the Pacific. Amongst its numerous rivers and lakes the principal are the Agusan, called at its mouth the Butuan, which has a length of 125 miles, for the most part navigable; the Pulangui or Rio Grande, which rises in the lakes of Liguasan and Butuan (Buluan?), and discharges its waters into the ocean after a course of 75 miles, navigable at certain seasons for vessels of 12 to 14 feet draught; the

Cagayan, with a length of more than 83 miles ; and the Iligan, which originates from Lake Lanao (62 miles in circumference). Lake Liguasan has a periphery of 43 miles, and Lake Butuan the same. Mindanao is crossed by four chains of mountains. The first stretches in a north-south direction along the eastern side of the island from between Surigao and Butuan to Cape St. Augustine, and reaches its highest altitude in Mount Calalan. The second lies to the west of the first, and runs parallel to it from the Mountains of Hingog, on the west of the river Agusan, in the north, to the Bay of Sarangani in the south. Its culminating point is Mount Pantadon. The third range, which starts from the volcano of Apo (8819 feet), stretches north-westwards as far as the head of the Bay of Panguil. The last range originates at Point Canit, on the east coast, and proceeds westwards, crossing the three chains already mentioned and dividing into several subsidiary ranges ; then, after traversing the isthmus that is washed by the Bays of Panguil and Illana on the north and south, it terminates at Zamboanga, the westernmost extremity of the island. The natural fertility of Mindanao is turned to but little account, for of the total area less than 64,000 acres are cultivated. The chief products of the soil are coffee, cocoa, cotton, sugar-cane, and tobacco, of which only the first three are grown in sufficient quantity for export. Gold is found in the districts of Misamis and Surigao. The annual imports amount to about 800,000 dollars in value. The population of the entire island numbers somewhere about 845,000. Of these, according to unpublished documents prepared by the Jesuit missionaries, 350,000 are Negritos, who dwell in the plains and along the banks of the rivers and lakes, and are decidedly hostile to Christianity and the Spanish rule ; 300,000 are mountaineers, who are only partly under the sway of Spain ; and 194,316 are Christian subjects of that power. This last figure is derived from the census of 1881. Amongst the Christian natives primary education is provided for in 45 boys' and 40 girls' schools. The number who can read, or read and write, is estimated at 30,000. For administrative purposes the island is divided into five districts, —Zamboanga, Misamis, Surigao, Davao, and Kotta-bato. A sixth district is constituted by the island of Basilan, lying south of the western extension of Mindanao. The capital of the island and the seat of the Governor-General is Zamboanga, at its western extremity. The Jesuits maintain a staff of more than one hundred missionaries in Mindanao.—Don Canga Argüelles, in *Boletín de la Soc. Geogr. de Madrid*, Vol. xxii., Nos. 3 and 4.

AFRICA.

The Raian Moëris.—At the recent meeting in Manchester of the British Association Mr. Cope Whitehouse came forward with an important paper on the Raian Moëris, of which the following is an abstract:—

“The Raian basin is a depression to the south and west of the Fayum, between lat. 28° 40' and lat. 29° 30' N. Its northern extremity is nearly on a line with Beni-Suef, 73 miles south of Cairo. It is connected on the south-east with a narrow valley, hitherto unexplored, known as the Wadi Muélah. At previous meetings of the British Association it has been shown how the author of this paper was led to believe that some such depression must exist, and how, at first alone and subsequently accompanied by competent engineers, his observations were verified. It was his opinion that foreign engineers, about the fifteenth century before our era, had conceived a gigantic scheme for the regulation of the flow of the Nile and the redemption of the delta, utilising a depression in the desert as a storage reservoir to avert the excessive rise of the river, and to pro-

vide for the season of drought. In Lower Egypt there are three seasons. From April 1 to the end of July the discharge of the Nile is about 14,000 cubic feet per second, or an average of about sixty-two million cubic yards per diem. A very high Nile discharges 387,000 cubic feet per second, averaging 1310 million cubic yards per diem. Only about one-half of the delta (2,750,000 acres) is under cultivation for want of sufficient water. In the province of Gharbieh alone the area of land capable of being reclaimed is reported by Mr. William Willcocks to be over 600,000 acres. Ten shillings an acre is the tax paid by inferior land in Egypt. If the summer supply in the Nile were sufficient for the irrigation of all the land, 2,530,000 acres could be reclaimed. The Egyptian Government requested Mr. Cope Whitehouse in December 1886 to carry out further surveys, and detailed engineers to work under his direction. A line of levels was run from Mazurah on the Canal of Joseph (Bahr Yusuf) sixteen miles to the west. At the sixth mile the desert is 177 feet above the Nile valley; at the ninth, 505 feet; at the fifteenth, 430 feet; and at the sixteenth, the Wadi Muḍlah is about $6\frac{1}{2}$ feet below high Nile at Beni-Suef (photographs shown). This line was continued to the NW. into the Wadi Raian, down to the level of the sea. It was checked by a line to the SE. and E. back to the Bahr Yusuf. A third line of levels was run between the Gharq and the Raian basins, which showed that at the level of high Nile (ca. $98\frac{1}{2}$ feet) these two basins are connected by a narrow defile. Another, and fourth, independent line of levels was carried from the west end of the Birket el-Querun, whose surface-level had been previously established as -131 feet, or about 230 feet below high Nile. Major Surtees, detailed by the War Office, at the request of Sir C. Scott Moncrieff, to accompany Mr. Cope Whitehouse, draughted a map with contours, which give the following data for so much of the depression as is below the Nile and available as a storage reservoir. Surface at $+98\frac{1}{2}$ feet (above sea), 1315 million square yards; average depth, nearly $98\frac{1}{2}$ feet; contents, 40,530 million cubic yards. Major Western, R.E., Director-General of Works, having been directed to examine the whole project, prepared an elaborate and most valuable report, showing that a further supply of 25 million cubic metres per diem for 100 days would meet all the requirements of Lower Egypt. This could be effected by filling the Raian basin at the time of high Nile, closing the canal of supply until the end of January, when the difference between the water in the reservoir and the river (about 16 feet) would permit a sufficient amount to flow back by the same canal. All objections, such as evaporation, leakage, deposit, infiltration, impregnation, loss of head were considered, and shown to be of no serious importance. The project is pronounced by the highest authority in all respects feasible. It is estimated that less than £1,000,000 would suffice for the works, which would consist of a canal across the Nile valley near Feshn, the improvement of the Bahr Yusuf, an embankment and basins in the Nile valley, a cut or tunnel of less than three miles between the Nile valley and the Gharq basin, an embankment of twenty miles to guide the water into the Raian basin, with incidental expenses for gates, bridges, etc. It is estimated that the revenue would amount to about two millions sterling, and the cost of maintenance would be inconsiderable. These researches, therefore, represent a capital value of, say, £50,000,000, and are believed to be unique if regard is had to the historical, archaeological, and geographical results, as well as to the purely practical question of the relief which would be afforded by an addition of more than one-third to the available resources of Egypt."

Major Surtees, having been detailed at the request of the Department of Public Works to accompany Mr. Cope Whitehouse, draughted a map with con-

tours of the Fayum and Raian depressions, a copy of which was shown and explained in detail.

The following testimony on the *Feasibility of the Raian Reservoir* was offered by Colonel Ardagh, R.E., C.B. :—"Having maintained a constant interest in the investigations of Mr. Cope Whitehouse, and having accompanied him into the Raian Basin, Colonel Ardagh offers the testimony of an impartial observer. Mr. Cope Whitehouse merits the thanks alike of antiquarians as of modern engineers for his researches relative to Lake Mœris. He has discovered a basin or depression, which is undeniably capable of being turned into a storage reservoir, fulfilling all the purposes of the ancient Lake Mœris at a comparatively moderate cost; and the financial result to Egypt of the construction of such a storage reservoir, capable of supplementing the insufficient quantity of water furnished by the Nile during the period of low water, and of thus enabling larger tracts of land to be kept in cultivation, would represent a very large profit on the capital invested, and a permanent increase in the produce of the country."

The Ancient Porphyry Quarries of Egypt.—At the same meeting of the British Association, Mr. W. Brindley gave an account of a recent visit to these quarries. Egyptian porphyry has been sought after from the earliest times, as one of the most precious of building stones. Ancient writers differed as to the whereabouts of the quarries from which that stone was obtained, and in modern times they were literally rediscovered by Burton and Wilkinson in 1823, and subsequently visited by Lepsius in 1845. The information published by these visitors proving of no immediately practical value, the author determined to follow in the footsteps of Wilkinson, and, accompanied by his wife, he came to Cairo in February last. Having examined the ancient granite quarries at the first cataract, which supplied deep red, rose, and dark grey stone, which was quarried by metal wedges, and not wood (as is generally supposed), the author started from Kenh with a small caravan and supplies calculated to last three weeks. Passing the remains of several Roman stations, the author, on the fifth day, reached an excellent well in the charming Wadi Kittar, hemmed in on three sides by precipitous mountains. Soon after leaving this valley he crossed the watershed (2400 feet above the Nile), and then travelled along the flank of the immense porphyry mountain of Gebel Dukhan as far as an old Roman station with an old fort. The morning after his arrival the author ascended to the top of a pass (3100 feet), without having found even a fragment of porphyry; but espying by the aid of a good field-glass porphyry colouring on the opposite mountain he resolved to go there, and his delight knew no bounds when he found the ground there strewn with pieces of the most sumptuous porphyry, and discovered a pitched way or slide, 16 feet wide, down which the blocks were lowered. Further examination led him to the locality where the Romans had extracted their grandest masses, and he found that these quarries had yielded not only the usual spotted variety but also the brecciated sorts and green-greys. The great quarry was at an altitude of 3650 feet above the sea, and a road led down from it to an ancient town with workshops. A path led hence to the old town in the valley, further up which are the ruins of a Roman temple. The blocks were formerly carried to the Nile, a distance of 96 miles, but they will in future be conveyed by a gentle incline to the Red Sea, which is about 25 miles distant. On his return to Cairo, the author secured a concession to rework the quarries, the terms of which have since been ratified.

Between the Nile and the Red Sea.—At the same meeting, Mr. E. A. Floyer, of the Khedivial Civil Service, described the country between the Nile and the Red Sea. The mountainous country between the Nile and the Red Sea partakes of much of

the interest, religious, commercial, and antiquarian, which so long has centred in Egypt itself. Long before the Christian era its mountain solitudes and picturesque valleys attracted the ophthoi, or the monks of paganism. At a later period these mountains sheltered the first Christian monks, and the existing monasteries of St. Anthony and St. Paul carry us back to this early age. A hundred miles to the south of them are the ruins of the monastery of the "Deaf Men," and near it, in the beautiful Kittar valley, near a crystal pool of water, and by the side of a running stream, rise the ruins of a Catholic church, perhaps consecrated by Meletius, the Arian bishop of the Thebaid, in the year 300. To the monks succeeded the convicts of the Roman Empire, who worked in the granite quarries of Mons Claudianus. For 1400 years the sole route between Europe and the far East passed across these mountains, and only ceased on the discovery by the Portuguese of the route round the Cape. Three roads, leaving the Red Sea at Berenice, Kosseir, and Myos Hormos, converged upon Koptos on the Nile, and were used according to circumstances. The crowning interest of these mountains lies in the ancient quarries scattered among their lofty peaks and winding valleys, and which were worked perhaps five or six thousand years ago. But for many years a sleep has fallen over these mountains; the ring of hammers was no longer heard, and the wells along the desert roads had become choked with sand. But a period of awakening has begun. Twenty years ago the Marquis of Bassano, with his thousand workmen, began digging in the Gimsa Well for sulphur; last year a colony of bearded miners set up their derricks and boring engines on Jebel Zeit, the oil mountain; and last, the fine porphyry, which can be matched nowhere in the world, is once more being quarried, and Mr. Brindley of London is actually the direct successor of Epaphroditos, the imperial freedman of Virginius, whom the Greek inscriptions show to have been the last lessee in the year 147 A.D.—more than seventeen hundred years ago.

The Emin Pasha Relief Expedition.—Major Barttelot, who was left at the camp at Yambuya, at the foot of the Aruwimi Rapids, with a garrison of about 100 men, has forwarded the following information to Leopoldville concerning Mr. H. M. Stanley's expedition:—

Major Barttelot received news from Mr. Stanley, despatched about July 12th, after he had made a ten days' march from Yambuya towards the interior. Mr. Stanley was at that date still proceeding up the Aruwimi, which he had found to be navigable up to a certain distance above the rapids. Here he launched a steel whale-boat, which he had brought with him, as well as several rafts manufactured by the expedition, which had been utilised for conveying heavy luggage. All the members of the expedition were in good health, and provisions were easily procured in the large villages near the river. The country through which the expedition was passing showed a gradual rise towards some high table-lands. Another caravan of 480 men was following the expedition on the left bank of the Aruwimi; the advance guard, consisting of 40 Zanzibaris, under the command of Lieutenant Stairs, being composed of men lightly burdened, whose duty was to search for provisions. Mr. Stanley expected to reach Wadelai in the middle of August, or even before. The advance had been so peaceably accomplished that Mr. Stanley had instructed Major Barttelot that, should it continue so, he would shortly send him orders to follow the expedition by the same route at the head of the hundred men left at Yambuya. Major Barttelot had paid a visit to the Falls, accompanied by Tippu Tib, and had left a detachment of twenty men there. Tippu Tib arrived at the Falls Station on June 16th.

According to a Reuter's telegram, dated Zanzibar, 17th September, tidings from the interior had been received the previous day reporting that the messengers who were sent by the Consuls there to apprise Emin Pasha of the despatch of Mr. Stanley's expedition, and who by last advices had reached Mlisa, on the eastern shore of Lake Albert Nyanza, have at length succeeded in making their way to the Pasha. They came up with him at the southern end of the Albert Nyanza, and joined his camp just as he was returning from his expedition to the Usungora country. The news they brought of the despatch of the relief expedition under Mr. Stanley greatly surprised Emin Pasha, and determined him, as he could not tell by which route the expedition would come, to return to Wadelai, having previously apprised the different posts occupied by his troops, on the western shore of the lake, of the circumstances which were inducing him to retrace his steps. When the messengers who are bearers of the above intelligence left Emin Pasha he was in good health, and was taking back a quantity of provisions from his expedition to Usungora. The emissaries of the Consuls were to have returned to the coast immediately after seeing Emin Pasha; but when the time came they refused to start, saying they had no wish to expose themselves afresh to the dangers which they had incurred on the way to the lake, especially as the route had become more perilous owing to a fierce war being waged between Mwanga, King of Uganda, and the neighbouring people of Unyoro. The troops of Mwanga had been defeated in two battles, and the country lying between Lake Albert Nyanza and Lake Muta Nzige had been completely laid waste.

The last letter from Mr. Stanley—perhaps the last for several months—was received by Mr. William Mackinnon on 22d September. It is dated from Yambuya (Aruwimi River), 23d June, and states that an early start of the steamers was anticipated. Mr. Stanley mentions a "difficulty" Major Barttelot had at M'Bungu whilst escorting Tippu Tib to Stanley Falls. "Seven of Tippu Tib's people were wounded while under his escort at this village, and a little battle took place. The Soudanese landed, drove the natives into the bush, and fired M'Bungu." Tippu Tib, it appears, has experienced a check in establishing his command at Stanley Falls; and it is feared that some of the Arabs may revolt.

Dr. Robert W. Felkin has received an important letter from Emin Pasha, dated Wadelai, 17th April, announcing the evacuation of Lado, the burning to the ground (through a mishap) of Wadelai, and the re-occupation of Makraka. Emin Pasha affirms his intention of holding and remaining in his province, even though a relief expedition may reach him.

The Wa-Bembé (Equatorial Africa).—*M. Josset*, a Catholic missionary stationed to the west of Lake Tanganyika, in a recent letter to his superior, the head of African Missions, makes mention of a race of people, called Wa-Bembé, who inhabit a range of mountains to the west of Tanganyika. They have hitherto escaped all proselytisers, and forbid Arabs and Mussulman Negroes to approach their villages, which are constructed on the steepest crests of the mountains. The tribe is divided into clans. They are agriculturists, and they supply with grain all the regions on the north-west of the lake. They sometimes come down into the plains for the purpose of exchanging the produce of their fields for agricultural implements (spades, etc.) and lances; but their visits are of short duration. Their country is said to be densely populated, and their villages to extend over a space of $2\frac{1}{2}$ miles.—*L'Afrique*, September 1887.

Cameroons.—In the German settlement of this name Dr. Zintgraff has for

the past few months been busy exploring the rivers and streams, in the hope of finding a navigable channel to the interior. But although he has partly explored the regions watered by the upper Vuri, the Dibombe, the Rumbi or Meme, and the district of the Bakossi Mountains, which were never before visited by Europeans, and later went as far as the Elephant Lake of Tomaczek, no stream was discovered that would be at all useful for penetrating to the interior, where, however, numerous Negro races were encountered, who are prevented by the coast tribes from getting down to the Gulf of Guinea for trade. In several places Dr. Zintgraff found the coffee-tree and caoutchouc.—*Deutsche Kolonialzeitung*, 15th August 1887.

Fernando Po (Gulf of Guinea).—Thanks to a valuable study of this island (with a no less valuable original map) by Herr Oscar Baumann, published in *Petermann's Mitteilungen* (Band xxxiii., No. 9), we are enabled to give complementary items of information to those contained in our short note of June last (p. 321).

Fernando Po forms the termination of the chain of volcanic islands which, proceeding from the Cameroon Mountains, runs south-south-west into the Gulf of Guinea. This transverse ridge of volcanic islands has arisen, there can be little doubt, from a fault which stretches from Cameroons to Annobon, and perhaps further. In shape the island resembles a nearly right-angled trapezoid, with its long axis pointing to the south-south-west. It is indented on either side by the Bay of San Carlos and Conception Bay. Orographically it consists of two divisions, that of the Peak of St. Isabella in the north, and a cordillera region in the south, united by the relatively low saddle of Loita (2874 feet). The peak of St. Isabella falls away gently towards the cliffs of the coast on the north and north-east, and on the west and north-west it sinks down to a strip of coastal lowlands in steep terraces, seamed with vast eroded trenches. On the east, the higher portion of the mountain is covered with somewhat steep woods down to a long grassy plateau, 1310 feet above the sea. Herr Baumann criticises the various measurements of altitude for the summit of the mountain given by previous students of it, and adds his own estimate, 9350 feet. There is said to be a crater at the top, 515 feet deep, with grey weatherworn basalt walls. Several secondary craters exist on the slopes; and the Bay of St. Isabella may be regarded as the remains of one such crater. The steep cliffs on the east, and the strip of lowland on the west, seem to warrant the conclusion that whilst the former side of the island is breaking down, the latter is being enlarged. The cordillera system of the south is, it is almost certain, older in date than the northern peak. Generally speaking, the system belongs to a ridge that has a westerly strike, and splits into two ranges united by a pass, of which the one to the west exceeds the other in extent and altitude. Both ranges have several rounded summits, the basaltic constitution of which gives them a volcanic appearance. Against the northern slope of the cordillera there abuts a hill, 2625 feet high, the summit of which is occupied by Lake Riba na Lobe—the “Devil’s Lake” of the Bubis—in all probability a secondary crater. The south-west extremity of the island is occupied by another volcanic system, larger than the cordillera, and almost separate from it. All the mountains of the southern part of the island present nearly perpendicular walls to the ocean, so that almost all the rivers descend in cascades. But the shores of San Carlos and Conception Bays are low and sandy. The island has numerous streams, whose sources seldom lie higher than 2130 feet. The method of valley-formation which is at work in the island is plainly seen from a vertical section. Along the middle of the valley floor runs a longitudinal ridge of rock, which slopes steeply down on either side towards the containing

rocky walls, which are undermined at their foot. The paper concludes with a series of barometrical determinations of altitude for several places named, and a few short notes on the petrographical character of certain specimens of rock brought home from the island by Herr Baumann, and examined by Dr. Max Schuster of the Vienna University. The specimens examined belong wholly to the basalts, particularly the plagioclase basalt.

AMERICA.

Origin of the Eskimo.—In the *American Naturalist* of August 1887, Mr. Lucien M. Turner criticises Dr. H. Rink's theory. The latter supposes that the Eskimo were originally an inland people, living somewhere in the north-western part of North America, whence they descended to the sea-coast along the rivers. In several articles, Dr. Rink tries to prove this theory by comparing the languages and customs of the different tribes. Though convincing proofs cannot be given, it seems very probable that the Eskimo have come from the rivers and lakes in the interior of America. This theory is open to criticism, but Turner's objections fail to convince us, and do not meet Rink's arguments. The latter is right in laying stress upon the fact that the Eskimo are not so exclusively a coast people as is generally supposed. The most difficult problem of the study is the difference of the tribes west and east of the Mackenzie. Rink emphasises the fact that the former have certain inventions which the latter have not, while other implements are more developed the further east we come. From this fact he concludes that the Eskimo first reached the sea and came into their present environment west of the Mackenzie, near the mouth of the Alaskan rivers. This theory, though not improbable, ought to be tested by a study of the anthropology of Alaskan and eastern Eskimo tribes. It seems to us that much of the difference may be due to foreign influence. An interesting paper on the anthropology of the Eskimo, more particularly of those of East Greenland, is contained in the *Bulletin de la Société d'Anthropologie* (ix. p. 608). While the population of Western Greenland is mixed with Danish elements to such a degree that there is probably nobody of pure Eskimo descent in South Greenland, this tribe has never mixed with Europeans. They are less dolichocephalic and slightly taller than the West Greenlanders and other eastern tribes. Their noses are described as being aquiline, but this also occurs among other tribes. The researches in East Greenland which were carried out by Lieutenant Holm show definitely that the tribes of the east coast never came into contact with the ancient Norsemen.—*Science*, Sept. 2, 1887.

The Botocudos (Brazil).—Dr. P. Ehrenreich has published the results of his study of the Botocudos of the Rio Doce in the *Zeitschrift für Ethnologie*. He discusses the observations of former travellers, and compares them with his own experience, thus giving the best sketch of this interesting nation which can be obtained at the present time. Dr. Ehrenreich has collected a considerable amount of anthropological, ethnological, and linguistic material. He gives a number of craniological and anthropometrical measurements, sketches the life of the tribes, who are at a remarkably low state of civilisation, and gives a vocabulary—which he has compared with the older ones of Martius—and brief grammatical notes. His researches lead him to the conclusion that the Botocudos formerly occupied a more extensive territory than they do at the present time, namely, a tract of land which extended from the coast far westward. They are related to the Ges nations, who inhabit the central parts of Brazil, and a member of whom was discovered by Von Steinen on the upper Xingu. It is of

importance to know that the Ges and the Botocudos wear labrets and ear ornaments, that their ceramic art and methods of navigation are very primitive, and that they do not use the hammock. Ehrenreich is of the opinion that the Botocudos remained in an earlier stage of development than the Ges nations, who migrated west, and came into contact with other peoples, while the former remained isolated. He believes that the remains found in the caves of the province of Minas Geraes belong to the ancestors of the Botocudos.—*Science*, September 2, 1887.

AUSTRALASIA.

Explorations in New Guinea.—During the past few months Messrs. C. Hartmann and George Hunter have been trying to cross New Guinea from Port Moresby, on the south coast, to Dyke Acland Bay, on the north-east coast. They reached the summit of the dividing range, near Mount Obree, which is about half-way between Port Moresby and Dyke Acland Bay.

Mr. Hartmann, in a letter to Baron von Mueller, furnishes some particulars of the journey. The party, consisting of the two gentlemen named, left Port Moresby, with twenty-seven natives to carry burdens and to cut the track, and after three days' journey reached Rigo, where more natives joined the party. After a short stay at Rigo the party started for Dr. Clarkson's last camp, which is at the foot of the range, and was reached after three days' journey. From every village the party passed a large number of natives followed them, and when the foot of the range was reached there were nearly 200 natives in attendance. The very bad weather that was experienced prevented very rapid progress being made, but after two days' rough travelling the summit of the range was reached. Here the party were compelled to halt owing to the exceptionally wet weather, and they then decided to return, but will resume the expedition, and make another attempt to get across the peninsula, when the weather improves. Mr. Hartmann had a good opportunity, however, of seeing the country to the north of the range, and he states that a fine large valley opens up from the summit of the range, east-by-north, to Dyke Acland or Collingwood Bay, with a long spur towards the main range to the left. The soil below the deposit of humus was found to be of stiff reddish or yellowish clay, whilst the rocks are broken and flinty. There are numerous palms and ferns, one palm in particular being very beautiful, the leaves, when young, being quite crimson. There are also bamboos, musas, aroids, pandanus, orchids, dracenas, begonias, and many other rare plants of which he has a goodly collection. If the leaders of the party had not been experienced men, with a thorough knowledge of the natives' character, in all probability the whole party would have been killed. When nearing the Saromogors, which is on the main range, and which the people in the locality believe to be the abode of the souls of their departed friends, the natives assembled in great force to destroy the party. Mr. Hartmann and Mr. Hunter were, however, equal to the occasion, and contrived so to ingratiate themselves with the natives that, instead of killing them, they became the best of friends, and finally acted as guides, so that when the summit of the range was reached, there were fully 300 natives with the expedition.

GENERAL.

On the Effect of Continental Lands in altering the Level of the adjoining Oceans.—Professor Edward Hull, LL.D., F.R.S., read an important paper on this subject at the recent meeting of the British Association. The following is an abstract:—

The effect of the attraction of continental land upon the oceanic waters adjoining seems to have been very much overlooked by British physical geographers. That some slight effect results from the elevation of the surface of the ocean in proximity to the coast is generally admitted, but the amount of rise is considered to be small, perhaps insignificant. The prevalence of these views was attributed by the author to the widespread influence of Lyell's hypothesis of the uniformity of the ocean-surface all over the globe.

The author's attention had been called to the subject by the perusal of the works of the German geographers Suess¹ and Fischer,² especially the latter; and he had received great assistance in his investigations from Professor G. G. Stokes, Pres. R.S., and from the Rev. Maxwell Close, F.G.S., which assistance he gratefully acknowledged.

In attempting to determine the relative levels of the ocean surface along the margins of continents as compared with those of mid-oceanic islands, the German authors above quoted had based their results on observations of the length of the seconds pendulum. Many years ago (1849) Stokes had shown that the force of gravity must be greater in such islands than on continental stations,³ and Airy had corroborated this conclusion by showing that it corresponded with actual observations on the length of the seconds pendulum at stations all over the globe.⁴ The formula of Suess and Fischer based on these was to the effect that the difference in the level of the ocean between two such stations was found in *mètres* by multiplying the difference in the number of daily oscillations in the seconds pendulum by 122. This in the case of the stations of California (or Mexico ?) in lat. $21^{\circ} 30'$, and of the Sandwich Islands, would amount to 4520 feet; a very startling result if correct.

The author proceeded to discuss the effect of continental lands, showing that this was in the first instance divisible under two principal heads: the effect (1) of the unsubmerged, and (2) of the submerged masses. In the former case, where the mass rose above the surface, one component of the attraction acted in a more or less vertical direction; in the second case all in a lateral direction, but both had the effect of elevating the surface of the ocean. The horizontal distance to which the vertical effect extended owing to the curvature of the earth's surface was then considered; and it was shown that, where continental lands rise from a deep ocean, the effect of the lateral attraction far exceeds that of the vertical attraction of the unsubmerged mass. Professor Stokes had furnished the author with a hypothetical case, in which the elevation of the ocean was estimated to reach 400 feet above the mean geodetic surface of the earth.

For the purposes of illustration three cases were selected, viz. :—

- (1) The table-land of Mexico, between lats. 18° and 26° N.
- (2) The table-land of Bolivia [and Argentine Republic] 19° and 26° S.
- (3) The Andes of Chili, „ 26° and 35° S.

The mean elevations, distances from the ocean, and extent having been determined, the results of the attraction of the mountain masses in each case were as follows :—(1) Mexico, 230 feet; (2) Bolivia, 301 feet; (3) Chili, 63 feet; the elevations being calculated above a mean geodetic surface.

¹ Suess, *Das Antlitz der Erde* (1887).

² Fischer, *Untersuchungen über die Gestalt der Erde* (1886).

³ Stokes, *Cambridge Philosophical Transactions*, vol. viii. pp. 672-695.

⁴ Airy, "On the Figure of the Earth," *Encyclop. Metropolitana*.

To the above results, due to the gravitation-potential of the elevated masses were to be added those due to the following factors :—

- (a) The marginal plain or emergent tract on either side of the mountain mass.
- (b) The high lands both to the north and south of the special sections above dealt with.
- (c) Lastly, and most important, the submerged continental mass.

To provide for the sphericity of the earth deductions of various amounts, according to circumstances, were made from the numbers obtained from the formula which Mr. Close had arrived at by a double process, and which is given at length in the paper itself.

Combining these results with those given above, we obtain as the whole rise of the ocean surface as follows :—(1) Mexico, 780 feet ; (2) Bolivia, 2159 feet ; (3) Chili, 1582 feet.

In all the above cases the coast was taken as descending to a depth of 15,000 feet at a gradient of about $\frac{1}{4}$ to $\frac{1}{50}$, the comparatively low results in the case of Chili being due to the narrowness of the mountain range, 30 miles in mean breadth, as compared with 300 miles in the case of Bolivia. The total calculated rise of the ocean waters at a distance of 900 miles from the coast in lat. 10° S. would amount to 2568 feet.

The above results, which are probably rather under- than over-estimated, fall considerably short of those to be drawn from Suess and Fischer's formula, but are probably much in excess of the views held by British physical geographers generally ; and the conclusion was drawn that if the same processes of reasoning and calculation were applied to all parts of the world, it would be found that the ocean waters were piled up to a greater or less extent all along our continental coasts, producing very important alterations in the terrestrial configuration as compared with an imaginary ellipsoidal or geodetic surface, to which all these changes of level must necessarily be referred.

Rainfall in the Atlantic and Indian Oceans.—Two valuable "Graphic Diagrams of the distribution of the rainfall over the Atlantic and Indian Oceans, according to geographical latitude and the season of the year," are given by Dr. W. Köppen in the eighth issue of the organ of the Hydrographical Office of the German Admiralty for 1887. They are constructed after materials collected at the marine meteorological stations by Dr. Sprung and Dr. W. Köppen for the Atlantic, and by Dr. von Danckelman for the Indian Ocean. The observations of the former gentlemen belong to the five years 1868-72, and include 161 daily records. Older publications of Dutch and English official observers were also employed. Dr. von Danckelman's labours are more extensive, and embrace 427 daily records, belonging to the years 1868-83, of which 242 fall in the last four years. The diagrams are arranged to cover the area bounded by 50° N. lat., 40° S. lat., and 20° and 40° W. long., for the Atlantic ; and 30° N. lat., 40° S. lat., and 80° and 100° E. long., for the Indian Ocean. The latitude is shown by horizontal lines lying five degrees apart ; the vertical lines mark the divisions between the months of the year. The distribution of the rainfall is indicated by areas, bounded by curves, and shaded darker in proportion to the amount of precipitation, the calculation being made on the basis of the number of rainy days in every one hundred on which observations were made. Thus the diagrams enable us to observe the yearly fluctuations of rainfall along any given parallel of latitude that falls within the limits laid down, as well as its distribution according to latitude at any precise period of the year.

In speaking of the northern half of the Atlantic, Dr. Köppen says :—" In higher latitudes there is a great frequency of rain at all seasons of the year, especially in winter ; but further southwards, as the region of the trade-winds is approached, all the months alike become less humid, particularly the summer months. Nevertheless no month can be called quite rainless north of the tropic zone, for there, on an average, one in every five to ten days brings at least a slight shower. South of the tropics circumstances alter ; towards the end of summer the tropical rains extend occasionally southwards, so that between 15° and 20° N. lat. there are two rainy seasons, early in winter and late in summer ; whilst in spring there falls scarcely any rain at all. Still further south the period of summer rains rapidly lengthens, so that the dry season is postponed to the months of February to April. South of 8° N. lat. the rainy season splits into two maxima, which unite again between 1° N. lat. and 5° S. lat., not however in summer, but in the months March and April, whilst August is rainless. Thus on no parallel of the North Atlantic does rain fall uninterruptedly throughout the year. Even on 5° N. lat., where the nearest approximation to perpetual rain is made, the frequency of rainy days always sinks to less than forty per cent. in March and August ; in May and June, November and December, it rises above seventy per cent. North of 8° N. lat., and south of 3° N. lat., seasons with a smaller frequency than twenty per cent. occur. In the south Atlantic autumnal rains are prevalent between 0° and 5° S. lat. From 5° to 14° the centre of the area bounded by 20° and 40° W. long. is characterised by a winter maximum of rainfall, and this phenomenon extends as far as 30° W. long. The results for the vast oceanic expanse south of 15° S. lat. do not rest upon such well-authenticated data as those of the more northern regions, and are therefore less trustworthy." All that seems sufficiently reliable is that a simple winter maximum prevails over that extensive area.

" In the Indian Ocean the zone of equatorial rains is of considerable breadth, especially towards the south. Throughout the entire region embraced between 2° N. lat. and 12° S. lat. the frequency of rainfall is in no month less than fifty per cent. ; between June and October inclusive it rises above seventy per cent., and spreads westward so as to include the Bay of Bengal. The only rainless areas belong to the colder season, and the most northerly zones ; they come in the north earlier in the year than in the south, and reach down to 10° N. lat. in February and March. In spring between 10° and 12° S. lat. the rains decrease very rapidly towards the south, and between 25° and 30° S. lat. this is the driest part of the entire year. Southward from 33° S. lat. the frequency of precipitation increases rapidly in winter and early in the year, the summer being the season of least rain. South of 40° S. lat. every eight out of ten days are rainy during the months of July and August.

" Comparing the four regions—the northern and southern portions of both oceans—we find the nearest approach to agreement between the frequency of rainfall and its coincidence with a given parallel of latitude to be in the areas on each side of the equator which are characterised by relative poverty in precipitation :—

	Atlantic.	Indian.
Northern Hemisphere, . .	April, 15° N. lat.	February, 18° N. lat.
Southern Hemisphere, . .	December, 8° S. lat.	October, 28° S. lat.

" In these areas the frequency in the northern hemisphere is almost *nil* ; in the southern hemisphere the Atlantic has a frequency of less than twenty per cent., and the Indian Ocean one hardly less than thirty per cent."

The Study of Geography.—The *Ausland* of May 9th contains an extract of A. Stauber's essay on the Promotion of the Study of Geography, which gained the prize offered by the King of the Belgians. The author discusses the methods which ought to be applied in primary teaching, in high schools, and in colleges. In the primary grade, the method is that of object-teaching. First, the geography of the child's own country is taught, beginning with the nearest surroundings, the schoolhouse or home, the village or city, the county, and so on. The close connection between natural history and geography must be kept in mind by the teacher, who is warned against overburdening the children's brains with names and dates. The drawing of maps and the use of charts are recommended; but Stauber remarks justly that not too much weight should be laid on the drawing of maps, which must only be practised as a means to impress the configuration of the earth's surface more effectively on the child's mind. In the upper classes an atlas ought to be used; but it is important to select maps which contain the proper amount of material, and show the geographical features of the country clearly and simply. After the native country has been thoroughly studied, the geography of the native continent, and later on that of the other continents, is taught. In high schools and colleges the analytic method gradually takes the place of the synthetic. The reading of travels is recommended as a means of making the study more attractive, and of preventing its becoming a mere memorising. The connection between natural history and geography must always be emphasised, and characteristic objects ought always to be shown. But, in order to be able to do this kind of work, teachers ought to be thoroughly conversant with the problems of geography. This can only be accomplished by the study of geography at a university. Therefore the establishment of professorships of geography is demanded. At the present time there are seventy-five such professorships at European universities. In Prussia, every university has its professor of geography; at other German universities there are lecturers. In England, geography will be taught in Oxford and Cambridge, as lecturers were appointed a short time ago. In Belgium, Greece, Portugal, Sweden, and in the United States, the science of geography is not taught by specialists; but, when it is taught at all, only incidentally.—*Science*, August 19, 1887.

MISCELLANEOUS.

The *Mouvement Géographique* of 11th September contains a useful chronological *résumé* of the principal events in the foundation of the **Congo Free State**.

Dr. Rink gives in the *Mitteilungen* of the Vienna Geographical Society (Bd. xxx., Nos. 7 and 8), a summary of the results of the **Danish Expeditions to Greenland** in 1885 and 1886, the leading facts of which have already been put before our readers.

The ninth annual *Report* of the *Verein für Erdkunde zu Metz* contains, amongst other papers, a useful monograph on the **Land and People of Transylvania**, which, however, is more historical than geographical. The writer is Lieut.-Col. von Fabrice. Of course the German colonists of the country occupy a large share of his attention.

According to the German *Echo* (15th September 1887), the German New Guinea Company have received a telegram from Cooktown intimating that the scientific exploring party, under the leadership of Dr. Schrader, has penetrated up the **Empress Augusta River** on board the steamer *Samoa* as far as 141° 48' E. long. Thus the river is navigable for a distance of about 310 miles, the *Samoa* having advanced 70 miles beyond the point where the *Ottilie* turned back.

NEW BOOKS.

Studies in the Topography of Galloway; being a List of nearly 4000 Names of Places, with Remarks on their Origin and Meaning, and an Introductory Essay. By Sir Herbert Eustace Maxwell, Bart. of Monreith. Edinburgh: David Douglas. Price 14s. Pp. xvi. and 340.

The title of this book is rather misleading, as it can scarcely be called a study in topography, seeing that it gives very little topographical information; but it contains an all but exhaustive list of the place-names of the two most southerly counties of Scotland; and for this useful piece of work Sir Herbert Maxwell deserves our best thanks.

The province of Galloway is less known, probably, to the travelling public than any other district on the mainland of Scotland; and as it was in it that the Celtic element is said to have held sway to a later period than in any other part of Scotland outside the Highlands, the influence of the Gaelic language on the names of people and places might be expected to be very marked. We should therefore expect, in a work of this kind, that the author, in giving the probable derivations of the names of places, would also describe the physical features of the places indicated, so that his readers might see how far they correspond with the physical aspects of places of similar names in other parts of the country. But this, so far as we have been able to judge from a careful perusal of his volume, Sir Herbert Maxwell has failed to do. This is the more to be regretted, as the author, from his personal connection with Galloway, and his thorough knowledge of the country, might have described many of the places he has named, and shown how far they agreed with their designations. "Names," says the author in his Introductory Essay, were not "invented for places. No mere combination of sounds can be contrived to designate hill or dale, river or lake; nor have they been named, as children now are named by their parents, according to fancy, interest, or family custom; but they received their appellations, as men and women did in former times, from some distinctive characteristic. . . . We may be sure that every place-name, however unintelligible to us, was originally as pregnant of meaning" to the old inhabitants "as such names as Albert Gate, Virginia, or Cape of Good Hope" are to people of the present day. "Although many of the place-names of Galloway have been worn down beyond all recognition, yet there are others in not a few of which the meaning is as clear as that of the inscription on a well-preserved coin; while a third class consists of those which may be identified by their similarity to names in other Celtic districts, the original forms of which have been enshrined in early manuscripts."

In the face of this opinion, it is a pity that the author did not describe the features of some of the places whose characteristics, from their names, are "as clear as that of the inscription on a well-preserved coin." It would certainly have enhanced the value of his book had he done so. In Sutherlandshire there is the parish of Tongue, and in Kirkcudbrightshire the parish of Tungland. Are the physical features of the two parishes alike? [Sir Herbert Maxwell gives the root *Teanga*, a tongue or strip of land.] There is a Lairg in both counties, a Borgia or Borge, a river Fleet, and a Loch Fleet; and many names of farms are similar. It would be interesting to know whether these names were given from their natural characteristics, or if settlers from the North brought the names to the south, or from the south carried them to the north.

The author refers the bulk of the names to a Gaelic origin. "These may

have been conferred at any period from the first occupation of Galloway by the Gaels down to the time when Gaelic ceased to be the vernacular of the province. To the first of these limits it is difficult to assign an approximate date; . . . but to go no further back than the fourth century, when St. Ninian began the conversion of the Galwegian Picts, Gaelic names may have been conferred at any time between that and the sixteenth century, or for a space of 1200 years. Most names of hills, rivers, cliffs, and other permanent and striking landscape features may most probably be assigned to the earlier moiety of that period, while those of houses and fields would be gradually conferred as the country became settled and cultivated." Hence, from the sixteenth century onward, an admixture of English or Lowland Scots names with the Gaelic would be a natural result, and this explains the origin of many of the compound names which are found in the district.

A deserved compliment is paid by Sir Herbert Maxwell to the maps of Timothy Pont. Four of these maps are devoted to Galloway; and though, owing to their having been engraved in Holland, some of the names of places have a Dutch look, yet the value of the rendering of these names, as they sounded in Pont's ear in 1600 and the ten succeeding years, cannot be exaggerated, even when we allow for the arbitrary spelling of the period.

It is to be understood, the author says, that no more is claimed for his pages than that they are to be looked upon as a "contribution to the study of the local names of Galloway. Difficulties in themselves," he adds, "most forbidding, and almost sufficient to stop even an accomplished Celtic scholar on the threshold, might well have deterred a humble student such as the present writer. But it seemed to him that some portion of what had been done for Ireland by O'Donovan, Reeves, Joyce, and others, may some day be accomplished for Scotland; and if the collection and systematic arrangement of names, and their collation with those conferred in Ireland by a people speaking the same language and leading similar lives, should prove an assistance to those who, in future, may undertake the work with higher qualifications for success, then it may be that the labour connected with the task has not been altogether wasted."

The author's chief guides apparently have been Dr. Joyce's *Origin and History of Irish Names of Places*, and Professor Rhys's *Lectures on Welsh Philology*. As we have already mentioned, we have only one fault to find with the volume, and though we may differ with the author as to some of his derivations, yet he is free from the objection of straining after etymologies. We cordially recommend the volume, and hope Sir Herbert Maxwell may continue his "Studies," and confer further favours on students of local etymology.

Commercial Geography, considered especially in its relation to New Markets and Fields of Production for British Trade. By KENRIC B. MURRAY, F.R.G.S., F.R.S.S., Secretary to the London Chamber of Commerce. Pp. 198. Edinburgh and London: Thomas C. Jack, 1887.

This work is a very useful compendium of available information as to new markets and fields of production. The statistics afforded in various official returns of foreign countries and British consular reports have been carefully collated, and made to form an accurate basis for a systematic description of the productions and trades of all parts of the world, *except Europe and the United States*. The discussion of the data is fair and as full as the limits of the work admit, special prominence being given to old and new countries where there is a prospect of British trade being retained, extended, or developed. The British colonies and dependencies receive a large share of attention, and the growing

tendency in them to manufacture for home consumption and even exportation is fully analysed. The author clearly distinguishes between markets ready for immediate opening or extension, and those requiring education, in many cases prolonged, before they are of any real importance for our enterprise. China is a striking example of the former, Africa and New Guinea are of the latter. With regard to the former he gives much valuable information, gleaned from many reliable sources, as to the special requirements of customers which must be attended to if British traders are to make headway against foreign competitors.

The definition of the scope and meaning of Commercial Geography given in the opening pages is, we believe, too limited, inasmuch as it excludes consideration of fully or fairly civilised States. At the present time, when public interest has been aroused in the subject, it would be well that its full import were realised. Of course certain aspects call for more immediate attention, and the present work is a valuable contribution in a most important department.

Illustrated Europe: from Paris to Milan via Mont Cenis. By V. BARBIER.
With 78 Illustrations by J. Weber, and 2 Maps.

Illustrated Europe: Canton Glarus and the Lake of Walenstadt. By ERNST BUSS. With 57 Illustrations by J. Weber, and 2 Maps.
Zurich: Orell Füssli and Co.

These delightful little books are enriched by numerous illustrations, many of which are gems of wood-engraving. The text—descriptive of the scenery of the country, its people, fauna, flora, and geology—is supplemented by notes for excursions. The two volumes before us belong to a series already numbering upwards of seventy, each of which is devoted to a certain district or town in Central Europe.

The Handbook to the Rivers and Broadwaters of Norfolk and Suffolk. By G. C. DAVIES. With Map. Norwich: Jarrold and Sons. Price 2s. 6d.

With this book we are under the guidance of an enthusiastic "Broad yachtsman," who writes pleasingly of the beauties and attractions of the Norfolk and Suffolk Broadwaters. The book contains all practical information for intending visitors, and is evidently the result of a very thorough knowledge of the country. A good large-scaled map fully illustrates the routes.

Anglo-American Practical Guide for the Continent of Europe. Part 1. Special Issue. Price 5s.

Practical Swiss Guide. Price 2s. 6d.

Practical Guides (condensed)—France, Belgium, Holland, and The Rhine. Price 1s. London: Trübner and Co.

These guides set forth that their object is to let the tourist "see all that is to be seen, in the shortest period and at the least expense." To a certain extent they realise their aim: their information is well-considered, concise, and to the point, but the complete absence of proper maps, with the exception of one or two rough sketches, is a felt want. A guide without maps is like a house without windows; tourists using these guides must be at the trouble of making a special collection of maps to illustrate the routes described.

Cook's Guide to Paris. New Edition. With specially engraved Map and Vocabulary of French Phrases. Price 1s.

Cook's Handbook for London. With Maps. Price 6d.
London: Thomas Cook and Sons.

The chief characteristic of these little books is their extreme practical

simplicity. Messrs. Cook, from long experience, know what kind of guide-book the general public require, and, accordingly, the principle of their books seems to be to tell briefly "What to see," and "How to see it."

NEW MAPS.

ATLASES.

STANFORD'S LONDON ATLAS of Universal Geography, exhibiting the Physical and Political Divisions of the various Countries of the World. Ninety Maps, with a Geographical Index. Imp. folio. Dedicated by permission to Her Majesty the Queen.
London: Edward Stanford. Price £12.

This is the most costly atlas at present published; it is specially dedicated to Her Majesty the Queen as a record of the state of geographical knowledge in the year of Her Majesty's Jubilee; and it is published by the leading and most reliable map publisher in England. These being the main facts, we are of course led to great expectations; we are hopeful that Stieler may be rivalled, if not surpassed, and quite prepared to realise that the present *Royal Atlas* is to be eclipsed.

But we much regret that the result of our examination of the handsome volume is disappointing. In many respects the atlas is decidedly the most modern and complete in existence, especially as regards Great Britain and the colonies, to which no less than 50 maps are devoted, which is almost all that one could reasonably wish for. Among these there are some very fine specimens of cartography—such as the large-scaled maps of England, Scotland, and Ireland in sections; also the Physical and Statistical Maps of the British Isles, including Mr. Buchan's valuable sheet of meteorological charts; the maps of Australia, India, and Cyprus are also good, but that of Ontario and Quebec is very bad. It is not to be expected that an English atlas should treat other countries with the same fulness and detail as our own possessions, but we might presume that the commercial and social importance of such a vast English-speaking country as the United States would deserve more than one general map for its representation, especially when we find a large folio plate devoted to such a small and distant group of peat-boggy islands as the Falklands, with only 1500 inhabitants.

However, apart from the different claims of foreign countries for large-scaled maps, the really disappointing feature of the atlas is that so many of Mr. Arrowsmith's old maps are retained. We do not in the least depreciate the work of John Arrowsmith, for no better or more thorough map-work has been done in England since his day; but he had not the advantages of modern surveys; and, although his work was as perfect as it could be made at the time, it is by no means perfect now—as will be seen on inspection of such old plates as the general map of Scotland (No. 21), Switzerland, Greece, China, Canada, etc.—maps which it is absurd to characterise as representing the present state of geographical knowledge. Mr. Stanford, in his Preface, openly states that the atlas is based on Mr. Arrowsmith's maps but adds that these have been corrected to the present date. In many cases we will allow that they have been very thoroughly overhauled, but some of them are past correction—indeed, the only cure for them would be to erase everything and redraw the map.

It is to be hoped that Mr. Stanford may consider it necessary to replace the old maps with new ones, and otherwise add to and improve his atlas; it may then be what we had hoped it would have been to commence with, "The Standard British Atlas."

BERGHAUS' PHYSIKALISCHER ATLAS.—Elfte Lieferung. Inhalt: Nr. 33, Isobaren im Januar (Dr. J. HANN); Nr. 44, Florenreiche (Dr. H. BERGHAUS, Dr. O. DRUDE); Nr. 73, Amerika um 1880 (Dr. G. GERLAND). *Preis M.3.*

Zwölfte Lieferung. Inhalt: Nr. 2, Tiefländer (Dr. H. BERGHAUS); Nr. 34, Isobaren im Juli (Dr. J. HANN); Nr. 58, Häfer (Dr. W. MARSHALL).

Gotha: Justus Perthes, 1887. Preis M.3.

Half of the maps comprising this great atlas are now published. The Meteorological Section is completed, and most of the Botanical Maps are issued, although, as there is no system in issuing the plates, one cannot tell when the section may be finished. Specially interesting, from a physiographical point of view, in the last issue, is the plate mapping all the land depressions below the sea-level, and showing what scope our engineers have for making inland seas. A glance tells us that the flooding of the Sahara depression would only form a good-sized lake instead of a vast inland sea, as was at one time stated, and also that the proposed Jordan Valley Canal would be "the route to India" were it not for the Isthmus of Akabah.

IMPERIAL GLOBE ATLAS of Modern and Ancient Geography, containing 33 Imperial Quarto Maps, with an Alphabetical Index of 20,000 names.

London and Edinburgh: Gall and Inglis.

The title and external appearance of this volume are very imposing, but as a geographical guide we can say very little in its favour. The maps, which appear to be enlargements of smaller plates, were no doubt at one period very fair, but it is evidently a long time since the plates have undergone revision, and the shapes and boundaries of the countries are, consequently, rather antiquated. The work, in short, appears to have been issued without any editorial supervision.

THE UNCROWDED ATLAS of Political Geography, by T. RUDDIMAN JOHNSTON, F.R.G.S., containing twenty-four Maps and Diagrams.

London: Ruddiman Johnston and Co., Limited. Price 1s.

This atlas is a decided improvement on the ordinary run of elementary school atlases, and deserves special commendation for its clearness and simplicity, which are really the most important features in maps intended for the use of children.

POCKET ATLAS OF IRELAND, by JOHN BARTHOLOMEW, F.R.G.S., with Index and Statistical Notes.

London: John Walker and Co. Price 1s. cloth.

A companion to the Pocket Atlases of England and Scotland, already noticed.

EUROPE.

SCOTLAND, Johnstons' Reduced Ordnance Maps. Scale, three-quarters of an inch to a mile.

SHEET 18, Glasgow and the Trossachs.

„ 20, Edinburgh and Loch Leven.

„ 21, North Berwick and Fife Ness.

Edinburgh and London: W. and A. K. Johnston. Price 1s. each.

These maps are photolithographed reductions of the Ordnance Survey sheets, but the result as regards clearness and legibility is not satisfactory. The one-inch Ordnance Survey is already sufficiently crowded for its scale, and it therefore follows that the reduction of the identical work into a much smaller com-

pass will produce rather an indistinct map, even if reduced without the blurred imperfections of photolithography. One would, however, expect that these maps, issued by a geographical publishing house, would have been to a certain extent brought up to date; but in the neighbourhood of Edinburgh, for instance, we find such omissions as the new Leith Docks and Portobello Pier, also the railways to Abbeyhill, South Leith, and Musselburgh, while the track of what used to be called the "Innocent Railway" at Portobello is coloured in red as an open line.

ASIA.

CEYLON—Völkervertheilungskarte der Insel—, von P. und F. SARASIN, 1887. *Berlin: Verhandlungen der Gesell. für Erdkunde, Band, xiv. No. 4.*

MANCHURIA, compiled from the latest Russian documents, and information supplied by H. E. M. James, of the Bombay Civil Service. Scale, 1 : 4,200,000. *Proceedings of the Royal Geographical Society, September 1887.*

TRANSKASPISCHEN GEBIETE und von Nord-Chorassan.

Hauptsächlich nach General J. Stebnitzki's Karte von Transkaspien (1885) mit Nachträgen und der Routen der Forschungs-Expeditionen unter Dr. G. Radde, Dr. Walter, und J. M. Konschin, 1881 bis 1886. Massstab, 1 : 2,000,000. *Petermann's Mittheilungen, Jahrgang 1887, Tafel 12. Gotha: Justus Perthes.*

A very complete map of the Russo-Persian Frontier District, and the course of the new railway from Merv to the Caspian Sea.

AFRICA.

AFRIKA—Geologische Skizze von—, von Dr. G. GURICH. Massstab, 1 : 45,000,000.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 13. Gotha: Justus Perthes.

This is an interesting attempt at a geological map of Africa. Only the results of actual exploration are noted, and the scattered patches of colour denoting known formations show in a striking manner how very meagre our scientific knowledge of Africa really is.

EAST AFRICA, showing the recently arranged Political Boundaries. By E. G. RAVENSTEIN, F.R.G.S. Scale 1 : 8,000,000.

Proceedings of the Royal Geographical Society, August 1887.

FERNANDO PO—Nach eigenen Aufnahmen, konstruiert und gezeichnet von OSCAR BAUMANN, Mitglied der Prof. Dr. Lenzschen Expedition nach Aequatorialafrika 1885-87. Massstab, 1 : 200,000.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 14. Gotha: Justus Perthes.

WALVISCH BAY.—Originalkarte des untern Khuseibthales, von F. M. STAPPE. 1 : 225,000.

Petermann's Mittheilungen, Jahrgang 1887, Tafel 11. Gotha: Justus Perthes.

AMERICA.

ARGENTINA—Atlas General de la Republica—, construido segun los datos mas recientes bajo la direccion de Carlos Beyer, Ingeniero Geografo de la Casa Editora. Grabado y Revisado por los s.s. W. & A. K. Johnston, Propriedad esclusiva del Editor. *Buenos Ayres: Angel Estrada, 1887.*

NORTH AMERICA—General Map of —, 1887. Scale 1 : 7,160,000.

Edinburgh and London: W. & A. K. Johnston. Price, mounted, £1, 1s.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ON SOME RECENT DEEP-SEA OBSERVATIONS IN THE INDIAN OCEAN.

BY JOHN MURRAY

(Of the Challenger Expedition).

WHAT is now known as the Indian Ocean was at the dawn of history named the Erythræan Sea; the Phœnicians—those bold navigators of western waters—are said, by some writers, to have originally come from the shores of Arabia, and to have been at an early date familiar with this southern ocean. Necho, the son of Psammetichus, who flourished about 610 B.C., is reported by Herodotus to have sent some of his vessels, manned by Phœnicians, afloat on the Erythræan Sea with orders to return by the south of Africa and the columns of Hercules to the Mediterranean; the cruise was said to have been accomplished in three years. If this voyage actually took place, no trace of it has been left in the records of Egypt, nor the history of science, and it was generally disbelieved by ancient geographers. Yet Herodotus relates one circumstance which shows these Phœnicians must have reached southern latitudes. “They related,” he says, “on their return, that, in sailing around Libya, they had the sun on their right hand, which appears to me inconceivable, but which may appear possible to others.” From a very early date there would appear to have been a coasting trade between India and the Persian Gulf. But the voyage of Nearchus, one of Alexander’s generals, from the Indus to the Persian Gulf, is the earliest reliable record of these coasts.

Hippulus, an Egyptian navigator, who flourished about the beginning of the Christian era, was the first to observe the regular alternations in the direction of the monsoons of the Indian Ocean, and to profit by them to open up a route across the high seas from the Red Sea coasts to India; the shore routes followed up to his time were then abandoned, and a fresh impetus given to voyages in Oriental waters. Two doctrines were held by ancient geographers regarding the morphology of the Indian Ocean; the one, supported by Eratosthenes and Strabo, considered it to be connected with the Atlantic and the general ocean which surrounded the land masses; the other view, maintained by Hipparchus and Ptolemy, regarded the Indian Ocean, and also the Atlantic, as enclosed seas like the Mediterranean. Ptolemy's map represents the coast of Africa as running to the east, and connected by unknown lands with the coasts of China.

In the ninth century the Arabs made frequent voyages to the East, Soleiman, belonging to Siraf on the Persian Gulf, being the first, probably, who, crossing the Bay of Bengal, passed beyond the Straits of Malacca into the China Sea. He visited Pekin, and the narratives of his voyages evidently gave origin to the delightful stories of Sindbad the Sailor.

The Portuguese, after many ineffectual attempts, rounded the Cape of Good Hope in 1486, and in 1498 Vasco da Gama reached the coasts of India by the same route. Within twenty years of this last date the Portuguese pilots had made known nearly all the coasts of the Indian Ocean with sufficient exactitude for the first needs of navigation.

In 1521 the remaining ship of Magellan's squadron crossed the Southern Indian Ocean in completing the first circumnavigation of the world.

From the time of Magellan, the first navigator who attempted to take a deep sounding in the open ocean, down to the present time, our knowledge of the Indian Ocean has gradually become more definite and thorough, thanks chiefly to the labours of many experienced officers connected with the Hydrographic Department of our Admiralty. It is not many years since we knew little or nothing reliable concerning the depths, contours, and temperature of the deeper waters of this basin; but to all these departments of knowledge we now almost daily receive additions through the present energetic Hydrographer.

If we regard the Indian Ocean as bounded to the south by the 40th parallel, and in other directions by Africa, Asia, and the Australasian Islands (as represented on the accompanying chart), then it has an area, including the Red Sea and Persian Gulf, of 17,320,500 square miles, the area of the Red Sea being 158,750, and the Persian Gulf 77,450 square miles.

The deep-sea soundings in the Ocean are now sufficiently numerous to allow contour lines to be drawn with a somewhat reasonable degree of accuracy. These lines, as well as those showing the heights of the surround-

ing land, are represented on the accompanying chart, in accordance with the latest available information.

I have elsewhere estimated the area of the land draining into the Indian Ocean at 6,813,600 square miles, and the total annual amount of rain falling on this area at 4378 cubic miles.¹

The following table gives the calculated areas between the several sub-marine contour lines :—

INDIAN OCEAN.

	Fathoms.		Sq. miles.
Between	0 and 100		840,100
„	100 „ 500		762,650
„	500 „ 1,000		503,300
„	1,000 „ 2,000		1,595,000
„	2,000 „ 3,000		13,344,600
	Over 3,000		38,700
			17,084,350

RED SEA.

Between	0 and 100		61,950
„	100 „ 500		46,450
„	500 „ 1,000		48,400
	Over 1,000		1,950
			158,750

PERSIAN GULF.

Between 0 and 100		77,450
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From the above estimates the bulk of water in the Red Sea is found to be 67,700 cubic miles, and the mean depth 375 fathoms, the Persian Gulf 2,200 cubic miles, and the mean depth 25 fathoms, the Indian Ocean 44,376,800 cubic miles, and the mean depth of 2,286 fathoms.

The latest additions to the bathymetry of the Indian Ocean have been made by Captain J. P. Maclear, R.N., of H.M.S. *Flying Fish*, in the end of last and the early part of the present year. As a result of Captain Maclear's investigations, several shoals and dangers that have previously appeared on Admiralty charts have now been expunged, and interesting observations have been made with reference to deep-sea temperatures, and especially to deep-sea deposits.

The details regarding these deep-sea soundings are given in the following table :—

¹ *Scottish Geographical Magazine*, vol. ii. p. 75.

Latitude.	Longitude.	Depths in Fathoms.	Bottom Temperature.	Nature of Bottom.	Percentage of Carbonate of Lime in the Deposit.
10 42 S	124 52 E.	345			
10 33	124 13	820	...	Green mud.	
11 7	121 52	562			
11 5	121 50	837 ¹	...	Green mud.	
11 39	114 39	2900	...	Wire parted heaving in.	
7 3	103 1	1450			
7 3	103 1	1920	...	Green mud.	1.58
8 16	104 49	3000			
9 49	105 35	2450	...	Manganese nodules.	
10 29	106 0	2500	...	(?)	
11 4	105 31	1850	...	(Doubtful sounding).	
10 43	105 21	2480 ²	...	Radiolarian ooze.	
10 23	102 5	3050		" "	Those soundings marked Radiolarian ooze contained traces of carbonates though no carbonic acid was given off with dilute hydrochloric acid.
10 35	97 50	2200	...		
10 19	97 29	3040	...	Wire parted heaving in.	
9 49	97 58	3080	...	" "	
10 6	97 50	2780	...	Radiolarian ooze.	
9 54	97 42	3025	...	" "	
9 37	97 43	2945	...	" "	
9 52	97 22	2910 ³	...	" "	
6 22 N.	79 25	1250	...	Wire parted heaving in.	
6 3	79 18	1770 ⁴	...	Line " "	
6 0	79 12	1850	...	Wire " "	
6 11	79 8	1675	...	Blue mud.	34.14
5 52	79 0	1730	...	" "	36.74
5 48	79 34	1930	...	" "	30.15
6 12	79 30	1500			
5 53	76 50	1300	36° 0	Globigerina ooze.	54.38
6 56	75 10	1520	...	" "	
8 25	74 21	1545	36° 0	" "	68.26
9 10	72 50	1195	37° 0	" "	63.21
8 46	68 26	2450	35° 5	Red clay.	17.86
9 21	60 4	2006	...	Globigerina ooze.	76.04
9 34	59 53	1950	34° 7	" "	69.48
9 28	59 40	1950	...	Line parted heaving in.	
9 16	59 39	1300			
9 15	59 55	1200			
9 31	59 59	1350			
9 58	59 56	1525			
9 40	60 8	1100			
9 40	59 49	2150 ⁵	...	Globigerina ooze.	75.75
12 45	59 1	2080	34° 2	" "	64.86
13 5	55 34	1840	...	" "	57.81

¹ In 1884, in 11° 6' S. lat. and 121° 51' E. long., south of the Island of Savu, the water of the sea was observed to be coloured in such a way as to give origin to the inference that the ocean shallowed considerably in this place. It will be seen from this sounding and the one which precedes it that no trace of any such shallowing was discovered by the *Flying Fish*.

² This and the three preceding soundings were made in the vicinity of Christmas Island, and demonstrate how steeply that island rises up from the bed of the ocean.

To Captain Wharton, the Hydrographer of the Admiralty, I am indebted for the opportunity of examining the specimens of deep-sea deposits collected by the *Flying Fish* in the Indian Ocean. These are of very great interest, as they are without doubt the best series of deposits that have as yet been preserved from this Ocean. I was the more desirous of examining them as some reports of the *Flying Fish's* results have stated that *gravel* had been found in depths of 3000 fathoms at a great distance from land.¹ We have now a very great knowledge of deep-sea deposits, derived from an exhaustive study of the specimens collected during the voyages of the *Challenger*, *Tuscarora*, *Blake*, *Porcupine*, *Gazelle*, the ships of the various telegraph companies, and many other vessels. From the examination of a deposit it is possible to tell, approximately, the depth and latitude at which it was taken, and, with certain reservations, the longitude may also be roughly determined. To find *gravel*, in the ordinary acceptation of the term, at a depth of 3000 fathoms three or four hundred miles from land, is about the last thing one who has made a study of deep-sea deposits would expect. It turns out, however, on examination, that no gravel was brought up at the depth indicated, the statement being due solely to a clerical error in translation or copying for the press.

In tropical regions distant from land, and at a depth of 3000 fathoms, the deposit is apparently without exception a clay arising from the decomposition of fragmental volcanic matter—usually minute particles of pumice—mixed up with which there are, in proportions varying with position, shells of Foraminifera, tests of Radiolarians, frustules of Diatoms, and minute wind- and current-transported particles. Occasionally there are sharks' teeth, bones of whales, cosmic spherules, and manganese nodules and zeolitic minerals, the two latter arising, as a secondary product, chiefly from the decomposition of the volcanic materials in the deposit. In the greatest depths there is scarcely a trace of carbonate of lime, but in depths of 2000 fathoms more than half of the deposits consists of this carbonate, which is composed almost entirely of the shells of pelagic Foraminifera which have fallen to the bottom from the surface waters. In still lesser depths the shells of Pteropods, Heteropods, and other pelagic molluscs, are found in the deposits, in

Notes to preceding Table continued :—

² About 400 nautical (=460 statute) miles west of Christmas Island, and north of the Cocos group, in 9° 53' S. lat. and 97° 48' E. long., the charts indicated shallow water, only 7 fathoms deep. But at this place the *Flying Fish* got soundings ranging from 2200 to 3080 fathoms (this and the six preceding soundings).

⁴ Off the south-west coast of Ceylon a bank (Behar Bank), with 30 fathoms of water, was marked as lying in 6° 4' N. lat. and 79° 13' E. long. This the *Flying Fish* was unable to discover.

⁵ Another bank shown on the chart with 36 fathoms of water, between Cape Comorin and Cape Guardafui, in 9° 31' N. lat. and 50° 55' E. long., could not be found, although this and the eight soundings which immediately precede it were made in the same locality.

¹ *Annalen der Hydrographic*, 1887, viii. p. 315.

addition to the pelagic Foraminifera, and there the amount of carbonate of lime in the deposit may reach 90 or 95 per cent.

When the deposit is collected within a hundred, or a hundred and fifty miles of the land, all the pelagic organisms, and the other materials above mentioned, are usually found, but their presence is masked, sometimes completely, by the large amount of coast and river *débris*, the mineral particles becoming larger, more numerous, and more varied as the land is neared, till they make up, together with clayey matter, by far the larger part of the sedimentary depositions.

The excellent series of specimens collected by Captain Maclear in the deep water of the Indian Ocean illustrate these remarks, and they are all the more valuable, as they are from a region about which we, up to the present time, knew little or nothing.

At a distance of more than 200 miles to the south-west of Sumatra, near Christmas Island, and to the north of Keeling Island, Captain Maclear obtained eight soundings between 2450 and 3080 fathoms. In all of these the deposit was a Radiolarian ooze. More than 50 per cent. of this deposit was composed of the shells and skeletons of these beautiful organisms; the remainder consisting of clayey matter, minute fragments of crystals, and a good many fragments of pumice; only one or two fragments of pelagic Foraminifera were noticed, and reference to the above table will show that they contained only traces of carbonates. Previously deposits of Radiolarian ooze were only known from the Pacific. In one sounding to the north of Christmas Island, the sounding tube brought up broken pieces of a manganese nodule, similar to those found by the *Challenger* in like situations in the Pacific and Atlantic.

A sounding in 1920 fathoms, about 100 miles from the entrance to the Straits of Sunda, gave a green mud with 1·5 per cent. of carbonate of lime. A large part of this deposit consisted of fragments of pumice, which had as yet undergone little alteration, and was doubtless derived from that thrown out from Krakatoa during its recent eruption.

The soundings to the south-west of Ceylon at depths greater than 1600 fathoms are blue muds with from 30 to 40 per cent. of carbonate of lime, consisting mostly of the shells of pelagic Foraminifera; yet the bottom-living Foraminifera are more abundant here than at similar depths much farther seawards.

A sounding about 300 miles to the westward of the line of the Maldivé and Laccadive Archipelagoes, in 2450 fathoms, yielded a red clay with nearly 18 per cent. of carbonate of lime, made up almost entirely of broken fragments of pelagic Foraminifera. The mineral particles were minute, not more than 0·025 of a millimètre in diameter, with one or two exceptions; the majority of these were rounded, and appeared to be wind-transported. There were a good many manganese peroxide particles present, but pumice grains were not nearly so numerous as in the deep soundings near Christmas Island, and Radiolarians did not make up more than 3 or 4 per cent. of the deposit.

The remaining deep-sea samples from the Arabian Sea, collected by Captain Maclear, were brought up from depths ranging from 1195 to 2150 fathoms, and are all Globigerina oozes, with, in some cases, 76 per cent. of carbonate of lime. The following is a list of the pelagic Foraminifera which make up the principal part of the lime in these Globigerina deposits, as well as in similar deposits in the tropical regions of the Atlantic and Pacific :—

<i>Globigerina (Orbulina) universa.</i>	<i>Globigerina cretacea (?)</i>
<i>G. sacculifera.</i>	<i>Sphaeroidina dehiscens.</i>
<i>G. æquilateralis.</i>	<i>Pullenia obliquiloculata.</i>
<i>G. conglobata.</i>	<i>Pulvinulina menardii.</i>
<i>G. dubia.</i>	<i>P. tumida.</i>
<i>G. rubra.</i>	<i>P. elegans.</i>
<i>G. bulloides.</i>	<i>P. canariensis.</i>
<i>G. inflata.</i>	<i>Candeina nitida.</i>
<i>G. digitata.</i>	

In addition to the above, Biloculinas, Uvigerinas, Truncatulinas, and arenaceous Foraminifera are present, but they never make up any large proportion of the deposit. Coccoliths, beaks of Cephalopods, otoliths of fish, fragments of Echinoderms also occur. Radiolarians make up three and four per cent. of some of these Globigerina oozes, and a few Diatoms are present in these as well as all the other varieties of deposits. The mineral particles consisted of small fragments of sanidine, augite, palagonite, glassy particles, and grains of manganese peroxide. Some of the minute rounded particles were quartz.

No shells of Pteropods, Heteropods, nor larval Gasteropods were observed in any of the samples preserved by Captain Maclear from the Indian Ocean, but they would doubtless have been present had he met with some lesser depths; a sounding of his in the Red Sea at 105 fathoms yielded them in abundance. They are also numerous in specimens of shallower water deposits sent to me from the Bay of Bengal, by Commander Alfred Carpenter of H.M.I.S. *Investigator*, and also in specimens from the east coast of Africa, collected by the telegraph ships. Commander Carpenter records that he has dredged some nodules off the coast of Ceylon in 675 fathoms, which show Globigerinæ in sections, and are said to contain a large quantity of sulphate of barium. The deposits in the Bay of Bengal are largely composed of detrital matter from rivers. Many of the shallower soundings along the shores of the Indian Ocean contain glauconite. Captain Maclear's temperature observations are also of much interest. A bottom temperature of 34°·2 Fahr. is recorded in latitude 12° 45' north, to the west of Sokotra. It is a remarkable fact that this temperature differs but little from that obtained by the *Challenger* at the bottom in latitude 50° south. Commander Alfred Carpenter tells me he has registered 33°·7 Fahr. in 2100 fathoms, in the Bay of Bengal. The dense warm tropical water which passes along the eastern shores of Africa, penetrates into the great

Southern Ocean south of India, and on reaching the latitude of about 50° south it sinks through the water of higher latitudes of the same temperature, but of less salinity, and it is then slowly drawn northwards as a cold indraught to supply the deficiencies caused by surface currents and evaporation in the tropics. It has frequently been observed by mariners that very sudden changes of temperature take place at the surface of the sea off Cape Guardafui.¹ This is now regarded as an effect of the south-west monsoon winds drawing up the deep cold water on the weather shores of Africa, to take the place of the water driven off along the surface before the winds. Similar phenomena are observed on the west coasts of Africa and South America in the trade-wind regions.

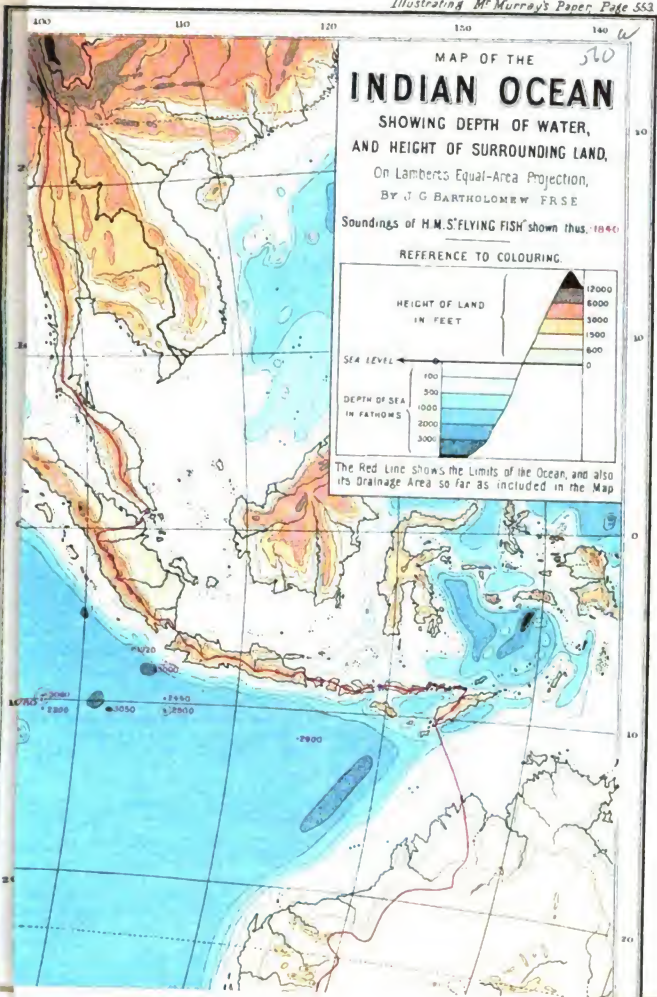
A remarkable instance of the effect of wind in drawing up cold deep water was observed this summer in Loch Ness by the writer. A moderate wind had been blowing from the east for several days, but on the morning of the 7th September it turned to the west, increasing to a moderate gale during the day. The following tables give the temperature observations made off Fort Augustus in 42 fathoms at 8.10 A.M., just as the west wind was beginning to blow, and at 6 P.M., after it had been blowing hard from the same direction for about nine hours. It will be noticed that the temperatures were much lower at all depths in the evening than they were in the early morning, and at a depth of ten fathoms the water was over 8° Fahr. colder than when the west wind first commenced to blow.

SERIAL TEMPERATURE OBSERVATIONS, LOCH NESS, OFF THE MONASTERY
AT FORT AUGUSTUS.

7th September, 1887.

Time, ...	8.10 A.M.	6 P.M.	
Wind, ...	W.	WSW.	
Force, ...	3.	5.	
Weather, ...	Overcast.	Rain.	
Sea, ...	Rippled.	Rough.	
Air Temperature, ...	53°·5.	...	
Barometer, ...	29·81 in.	29·71 in.	
Depth (fathoms), ...	42.	42.	
Fathoms.		Temperature.	
0		54·8	47·8
2		54·8	47·7
5		54·4	46·8
8		54·3	46·5
10		54·4	45·9
15		47·2	45·1
21		46·5	44·1
31		45·0	43·4
41		44·6	43·0

¹ See charts showing surface temperatures of the oceans, compiled by Navigating Lieutenant Baillie, R.N., and Buchanan on "Similarities in the Physical Geography of the Great Oceans:" *Royal Geogr. Society's Proceedings*, December 1886.





Although no direct observations similar to the above have been made in the ocean in the trade-wind regions off the west coasts of Africa and America, and during the south-west monsoons off the east coast of Africa, yet the observations we have indicate that in a short time there are great changes in the temperature of the surface and sub-surface waters amounting to 18 or 20 degrees Fahr. The absence of coral reefs and islands along the coasts just mentioned has long been remarked by all who have studied the distribution of corals and coral reefs. It is probable that such a sudden change of temperature would be sufficient to kill most of the reef-building species of corals, as well as most of the pelagic animals on which they chiefly feed; and to this cause may in all likelihood be referred the absence of coral reef on these coasts,—a fact in the distribution of reefs for which it was hitherto difficult to give an explanation.

THE NORWEGIAN NORTH ATLANTIC EXPEDITION.

BY WILLIAM E. HOYLE, M.A. OXON., F.R.S.E.

(Continued.)

METEOROLOGICAL OBSERVATIONS.—Meteorological observations were kept up on all three cruises by Professor Mohn, whose name is a sufficient guarantee for their accuracy. An Introduction to his Report describes the instruments used, and the methods of observation, but the details are too technical for reproduction here. Perhaps the most important novelty described is a neat form of atmometer, to be held in the hand, devised by the Professor, in connection with which is given an account of the experiments and calculations by which the correction to be applied to its readings was determined. The case containing thermometers for determining the temperature of the air was suspended from the forestay so as to have full exposure to the air without any risk of warming by the smoke from the funnel. An ingenious form of the atmometer was devised for determining the rapidity of evaporation; it consisted of a small basin of water arranged to float in a larger one; after a certain lapse of time the amount of evaporation which had taken place was ascertained by measuring the quantity of water requisite to restore the small basin to its former level. Thermometers were placed both in the inner and outer vessels.

CONTOUR OF THE SEA-BED.—At the outset of his discussion of this subject, Professor Mohn defines certain geographical terms applied to various portions of the sea to the north of Europe, and as these names are rapidly gaining currency in modern geographical writings, it seems useful to repeat their definitions here.

The *North Sea* extends northward as far as a line drawn from Stad in Norway to the Shetland and Orkney Islands; towards the north-west it opens into the Færoe-Shetland or "Lightning" Channel.

The *Norwegian Sea* is bounded by a line extending from Stad to the

Shetland and Færoe Islands, the east of Iceland, Jan Mayen, the south of Spitzbergen, and the North Cape, and thence by the Norwegian coast.

The *Greenland Sea* lies to the south-east of Greenland, and is bounded by the coast of that country, by Iceland, by a line drawn thence through Jan Mayen to Spitzbergen, and then by the west coast of that island. *Denmark Strait*, between Iceland and Greenland, connects it with the Atlantic Ocean, while by the *Jan Mayen Channel* it communicates with the southern part of the Norwegian Sea.

The *Barents Sea* lies to the eastward of a line drawn from Spitzbergen to the North Cape, and extends from Spitzbergen and Nova Zembla on the north to the coasts of Finmark and Russia on the south.

The *North Ocean* is used as a collective term including all these various smaller seas.

On the basis of the soundings of the Norwegian expedition, taken in conjunction with those obtained by a large number of previous investigators, Professor Mohn has drawn up a chart of the area explored, upon which contour lines are drawn at every 100 fathoms.

This map reveals a very irregular formation of the bottom, of which it is impossible to give any adequate idea without the aid of a diagram. Speaking generally, however, the following facts may be stated.

1. The North Ocean is separated from the main body of the Atlantic by a ridge which runs from the north of Scotland, by the Færoe Islands to Iceland, and thence to the coast of Greenland, the maximum depths over its three portions being respectively 330, 277, and 319 fathoms. Its most south-easterly portion is known as the "Wyville Thomson Ridge," having been discovered during the cruise of H.M.S. *Porcupine*.

2. The greater part of the North Ocean is a depression exceeding 500 fathoms in depth, near the centre of which the island of Jan Mayen rises like a pinnacle, the slope being especially steep on its north-eastern aspect.

3. Two areas exceed 1500 fathoms in depth; one is a curved patch lying between the parallels of 64° and 72° N. latitude, and bisected by the meridian of Greenwich, while the other lies to the north of this and to the west of Spitzbergen; the elevation which separates these is known as the "Transverse Ridge."

4. The North Sea, properly so called, is very shallow, a deep channel of from 100 to 200 fathoms in width extending close along the coast of Norway into the Skager Rack.

TEMPERATURE OBSERVATIONS.—For observing submarine temperatures reliance was mainly placed, during the first cruise, on the Miller-Casella thermometers, similar in pattern to those supplied to the *Challenger*; but subsequently instruments on the models of Negretti and Zambra were used more extensively. One of these was made to register its minimum by rotating under the action of a fan when drawn up; the other was contained in a hollow case loaded with shot, which held the instrument in one position whilst descending, and allowed it to become inverted as

soon as the ascent commenced. This was found to work well until the case became water-logged, and thus lost its buoyancy. Both these instruments have since been superseded by others in which registration is accomplished by a weight or "messenger," which is allowed to run down the line, and thus bring about the inversion of the thermometer with great certainty. This, the invention of Captain Rung, of the Danish Meteorological Institute, has been developed with much success at the Granton Marine Station. Buchanan's mercury piezometer, an instrument for measuring the combined effects of temperature and pressure, first used on board the *Challenger*,¹ rendered great service in checking the results obtained by other means, and a chapter is devoted to a critical discussion of its indications.

The most conspicuous feature in the distribution of surface-temperature is to be found in the way in which the isotherms are disposed in sharp bends like tongues, warmer areas projecting into colder areas, and *vice versa*. The central lines of these tongues are denominated by Mohn "axes of heat or cold." The most conspicuous are (1) an axis of heat running parallel to the coast of Norway till, about four-fifths of the distance up that country, it divides into two, one branch passing northward up the west coast of Spitzbergen, the other proceeding eastwards into the Barents Sea along the Murman coast of Russia; and (2) an axis of cold passing southwards to the east of Iceland, and reaching as far as the Færoe and Shetland Islands.

In regard to the distribution of temperature at the bottom, it is to be noted that the greater part of the bed of the North Ocean is covered with water having a temperature below -1° C., and furthermore that the boundary-line of the water which has a temperature of 0° C. follows the contour of the banks, so that the coldest water occupies the depressions, and is kept away from the near proximity of the coast. Off Vesteraalen, in Norway, this ice-cold water attains its closest proximity to the shore, about 20 nautical miles. Emphasis is also laid upon the fact discovered during the cruises of the *Porcupine* and *Knight Errant*, and formally enunciated by Mr. John Murray,² that this cold water is held back from passing into the main body of the Atlantic by the Wyville Thomson Ridge, south of which the water at the bottom is several degrees above the freezing-point of fresh water.

In addition, a detailed account is given of the distribution of temperature in the Norwegian fjords, and of its variations throughout the year.

DETERMINATION OF THE CURRENTS.—Starting from the position that surface-currents in the ocean depend mainly upon the wind, Professor Mohn proceeds, in the first instance, to ascertain the average direction and force of the wind over the North Ocean throughout the year; and, since the direct observations upon this are inadequate, he deduces the winds from the mean barometric pressure, of which the records are much more

¹ *Narrative of the Challenger Expedition* (1885), vol. i. p. 102.

² *Proceedings of Royal Society of Edinburgh* (1883), vol. xi. p. 654.

extensive and reliable. The results are given in a chart, upon which the isobars and the winds deduced from them are shown, indicating that an elongated area of low pressure, reaching say from Iceland to the North Cape, occupies the centre of the Norwegian Sea. The winds blow in a cyclone round it, the direction in the southern portion being from the south-west and south, and on the northern side from the north and north-east. Another map shows the resulting surface-currents, which, of course, follow the direction of the wind, keeping up a circulation, with an elongated area of rest corresponding to the low-pressure centre above mentioned.

As regards the currents in the deeper strata, and the general circulation in the Northern Ocean, the state of affairs may be roughly summarised as follows: the water of the North Ocean comes from two distinct sources—(1) the Atlantic; (2) the Arctic Polar Sea. The deeper waters of the Atlantic current are, of course, stopped by the Wyville Thomson and Faeroe-Iceland Ridges, whilst the superficial layers pass over into the North Sea. These, being denser than the remainder of its waters, sink, and constitute a layer between Iceland and Norway, characterised by high temperature, high pressure, and small amount of dissolved air. The Polar water, diluted during the summer by the masses of melting ice, passes southwards in a broad stream extending from the east coast of Greenland, as far as the eastern side of Jan Mayen. It mainly occupies the more northerly of the two deep basins of the Norwegian Sea. Thus, in the main, the southern basin of the Norwegian Sea is filled with Atlantic water, and the Northern with Arctic, the warmer water being associated not only with high pressure, high density, and high temperature, and small quantity of dissolved air, but also with a much larger amount of shells of *Foraminifera* and other organisms.

CHEMICAL INVESTIGATIONS.—The Chemical Report by H. Tornøe consists of the following sections—(1) the air dissolved in sea water; (2) the carbonic acid dissolved in sea water; (3) the amount of salt in sea water. It has added not a little to our knowledge of ocean chemistry. From a practical point of view, perhaps the most important item is the method devised by the author of determining the alkalinity of sea water. The estimations of the dissolved air and carbonic acid have been utilised by Professor Mohn in his discussion of the circulation of water in the Norwegian Sea just alluded to.

ZOOLOGICAL RESEARCHES.—To give an adequate account of that portion of the Zoological work of the Norwegian North Atlantic Expedition which has been already published would extend the present article beyond all reasonable dimensions; a due appreciation of the work must be left to the specialists in the respective departments. All that can here be attempted is in a few sentences to bring out the most salient features of each memoir.

The fishes collected by the expedition were handed to Dr. Robert

Collett for investigation, and his Report upon them was one of the first volumes published. The first two cruises yielded much fewer specimens than the third, during which special attention was given to the use of the trawl, which experience has shown to be much better adapted for their capture than the dredge. Omitting the commoner forms already known to occur at trifling depths off the Norwegian shore, the species collected during the expedition numbered thirty-four, of which seven were new. One of these is the type of a new genus, *Rhodichthys*, of special interest, being not nearly related to any fishes hitherto known from the north of Europe. Only a single specimen was obtained of about the size of a large herring, but broader and thinner, except as regards the head, which is very large from side to side; the tail is small, and a long forked filament hangs out from below the gill-cover on either side. The fish is of a bright red colour, and belongs to the *Ophidiidae*, a well-marked family of deep-sea fishes, examples of which have now been found in all parts of the globe.

Messrs. Danielssen and Koren, whose names have so long been associated in a literary and scientific partnership, have undertaken a large share of the zoological work in connection with this expedition, no less than four of the Reports already published being their joint work, while Dr. Danielssen has published one on the *Alcyonida* since the death of his distinguished collaborator. The *Gephyrea* are animals little known to the world at large, but of great interest to zoologists. A small but important collection was made by the *Vöringen*, seven new species being obtained, of which four are types of new genera; whilst one presented such peculiarities that a new family had to be created for its reception. *Epithetosoma norvegicum*—this being the name selected for the animal—has a sausage-shaped body about half an inch in length, to one extremity of which is attached a proboscis about $2\frac{1}{4}$ times as long as itself. The mouth, as is usual in this group, is situated immediately below the proboscis, and at either side of the latter is a groove, in the bottom of which is a row of apertures opening into the body-cavity—an arrangement found in no other species.

The collection of Holothurians, or sea-cucumbers, contained twenty-five species, six of which were new, five necessitating the erection of new genera. Two of these are noteworthy as belonging to the *Elasipoda*, a group instituted by Dr. Hjalmar Théel of Upsala, for certain forms discovered by the *Challenger*, and found only in the deep sea.

Of the *Asteroidea* (star-fishes), no less than twenty-one genera and forty-one species were collected, and of these, four genera and eleven species appeared to Messrs. Danielssen and Koren to be previously undescribed, although, owing to the scattered nature of the literature of the subject, and the fact that they had often only a single specimen to deal with, they do not feel certain that in some instances they have not been anticipated. One of the most remarkable novelties is *Ilyaster mirabilis*, a small five-rayed form, characterised by a long process arising from the centre of the upper surface. A similar appendage was found by Professor

Perrier in a star-fish from the north coast of Spain, to which he gave the name *Caulaster*, suggesting that the process was homologous with the stem of a crinoid. This view is also apparently adopted in the work under consideration; but Mr. Percy Sladen, from an examination of several similar forms in the *Challenger* collection, has been led to the conclusion that the resemblance is illusory, and that there is no real correspondence between these structures. The Report is illustrated by fifteen well-executed plates, the last of which exhibits the animals in their natural colours, from drawings taken from life by the skilful pencil of Mr. Schiertz. It is to be regretted that a similar course has not been followed more frequently in the case of other scientific expeditions.

The *Pennatulida*, or sea-ferns, were not numerous, but nevertheless they presented several new forms. Of *Umbellula ennerinus* (Linn.), the earliest known representative of the family, no less than twelve specimens were obtained, which furnished Messrs. Danielssen and Koren with material for a most elaborate description, both systematic and anatomical, of its structure. No less than eight large plates are devoted to its elucidation, the last being a beautiful coloured drawing of the animal, sketched during life by Mr. Schiertz. The *Alcyonida* are a very interesting group of polyps, which have been hitherto rather neglected, and hence the memoir of some 150 pages and 23 plates, which Dr. Danielssen has devoted to their consideration, deserves a special welcome. His work was carried out under great difficulties, the motion of the vessel rendering it impossible to make an adequate examination of the living animals. He has made the best use, however, of the material preserved in spirit, and has based his systematic conclusions upon anatomical examination as well as upon the forms of the spicules and external characters. One delicate branching organism received the name *Voringia*, from the vessel in which the investigations were conducted, and in it Dr. Danielssen was fortunate enough to discover groups of large ganglion cells, which seems to furnish our first introduction to a nervous system in these animals.

Dr. Armauer Hansen's Report on the *Annelida* opens with some valuable remarks on the classification of these animals. He criticises, as others have done before him, the excessive splitting up of genera to which Malmgren, his eminent predecessor in this field of inquiry, was addicted. He is disposed to lay but little weight—too little, as it seems to us—upon systematic characters derived from the bristles, preferring to rely rather upon the scales in such species as possess them. A very large number of forms were collected by the expedition, and separate lists are given of those captured in the cold and warm areas. Dr. Hansen's account of the collection of *Sponges* is unfortunately of much less value than it would have been had the specimens been better preserved. In many cases the labels, having been written in fugitive ink, were indecipherable, and the spirit had evaporated, so that no details regarding the structure of the soft parts and canal system could be made out, and even the exact locality from which the species were obtained could not be ascertained. Under

these circumstances the Report resolves itself into a mere description of the forms of spicules found in the various specimens.

Only two small instalments of the Report on the *Mollusca* have yet appeared, but these are sufficient to show that the material collected in this department is both abundant and important. In the first fasciculus, Dr. Friele deals with the *Buccinidæ* family, of which the whelk is the most familiar example, and which is well represented in the northern seas. Its large number of species, and their great variability, have taxed the skill of more than one eminent conchologist. The second part commences with the no less difficult family *Pleurotomidæ*, in treating which the author gives a revision of all the northern forms of the genus *Bela*, which, based as it is, not only on the specimens collected by the *Vöringen*, but also on the extensive series in the Tromsö Museum, cannot fail to be of assistance to future workers. Three groups are distinguished, a few isolated forms remaining unclassified.

The *Crustacea* have been undertaken by Professor G. O. Sars, whose researches into that class have already earned him a world-wide reputation. In 1885 two thick fasciculi were issued, illustrated by specimens of that admirable draughtsmanship to which he has so long accustomed us, and it will be a matter of universal regret that some of the coloured drawings made during the cruise were not reproduced each "in their own tinct," as in the case of the *Asteroidea*. The descriptions of the sixty-five new species and seven new genera obtained, occupy the whole of the two fasciculi mentioned above, which constitute Part I. of the memoir. A smaller instalment appeared last year, giving a complete list of all the species (more than 300) which were collected, along with elaborate tables showing their distribution in the Norwegian Sea and elsewhere; and a third part is promised, to be devoted to general considerations such as the effect of physical conditions on distribution, migrations, and the like.

Such is a very brief account of one of the best conducted and most important of the recent deep-sea expeditions. We can only hope that, with the improved apparatus which every year produces, it will have the effect of stimulating further inquiries in the same direction, until the problems, hitherto merely propounded, approach within reasonable distance of solution.

THE PHYSICAL GEOGRAPHY AND TRADE OF FORMOSA.

Read at Meeting of British Association, 1887.)

BY ARCHIBALD R. COLQUHOUN,

Hon. Cor. Member, Royal Scottish Geographical Society.

FORMOSA is intersected by a range of mountains, varying in height from 200 to 12,000 ft., following the general direction of the island from north to south, and forming its backbone. The range is called by the Chinese

Chü-Shan, or "Saw Hills." Its western slope is somewhat gradual, and falls to a large undulating plain on which the Chinese have settled. On the eastern coast the range descends precipitously, presenting a dangerous shore, exposed to the full blast of the Pacific. Even the western coast has no good harbours, and vessels are often compelled to lie off the island exposed to bad weather.

The only harbours are Keelung and Tamsui in the north, and Taiwan in the south-west. The Chinese are confined as yet to the western plain, to the harbours and villages of the western and northern coasts, and to a few settlements on the east, the main mountain range being inhabited by aboriginal tribes, gradually becoming subject to the Chinese, or being here as elsewhere exterminated by them,—the invariable result of the contact of aboriginal races with those of a superior civilisation.

The outline of the coast is very irregular, with numerous inlets and bold headlands. The island presents every variety of country—high peaks enveloped by mist and snow, valleys covered with luxuriant vegetation, and the extensive plain on the west, with its rich alluvial soil. Here are found nine-tenths of the whole population of Formosa. Through this plain the rivers, few and shallow, wind from the foot of the hills. On the wild, abrupt eastern coast, with its few sandy beaches, on which there is often a heavy swell, is only one fertile plain of any considerable extent.

This valley, known commonly as Kapsulan, and officially as Komalan, commences some 25 miles south of Keelung, and extends for some 14 miles farther south to Sauo Bay. Its greatest width is some seven miles, the inland boundary being a semicircle of mountains. Within the valley—one large rice field—are situated 35 villages and several thriving towns, the principal of these being Lotong, a well-built town with a population of a few thousands, and with some trade. Although settled only since the beginning of this century, and in the early years of its occupation the resort of outlaws, it can now boast of a very orderly and respectable community, who live well upon the products of the fertile soil.

The original inhabitants of the plain, called by themselves Kabaran, have been compelled by the Chinese to retire from the open country to the lower hill-slopes, where they are forced into contact with the untamed aborigines dwelling within the dense forests.

The amount of level land to be found along the whole broken, steep, eastern coast is exceedingly limited, the precipitous and thickly-wooded mountains coming for the most part sheer down to deep water. On the few small bays with patches of plain land which are to be found Chinese communities have settled. The lower slopes of the hills are being gradually denuded of their covering, the edge of the wooded tracts being invariably the boundary line between the territories of the settlers and the natives. On the east the streams are fierce mountain torrents, more like waterfalls than rivers, rendering navigation of any sort impossible.

The great drawback of Formosa and to its development is the absence of good deep-water harbours, and the recurrence of violent typhoons in

the Channel, rendering navigation difficult and dangerous. The east coast is not visited by the full strength of the north-east monsoon, presumably owing to the precipitous and rugged character of the mountain slope. But though there is practically no harbour of any value on the east coast, those on the west coast are mere roadsteads, with few exceptions, only admitting vessels of light draught, up to 10 or 12 feet. The coast line, except in the north, is a succession of sand-banks and shoals.

From the brief description given of the main ports which are open to foreign trade—Keelung and Tamsui in the north, and Taiwan and Takow in the south—it will be seen what enormous, almost insuperable, difficulties exist in the way of navigation. The northern part of Formosa is high and mountainous, with the exception of its north and north-west points, which are low, with reefs extending a considerable distance off the coast. The sea here has a great depth.

The scenery in the immediate neighbourhood of Keelung is very fine, with picturesque knolls and undulating wooded hills coming down close to the water's edge, while behind these the mountain-range of Tamsui, generally covered with clouds, rises to 2800 feet above the sea. The slopes of verdure and vegetation form a fine contrast with the flatness of the western coast, and with the general sterility of the northern mainland.

Northern Formosa is volcanic, as might be expected from the fact that it is situated between the two great volcanic centres, Japan and the Philippines. The river at Tamsui, and the alluvial plain at the back of the town, form a natural boundary between the Tamsui mountain system and that of the main mountain backbone of the island. The hills here are composed of stratified rocks which have been tilted up by the igneous rocks. At Keelung sandstone is the predominating formation, and assumes the most fantastic shapes. North of Tamsui the beach is a field of lava, seamed and cracked, with deep gullies, and is not improbably the outer edge of a submarine eruption. At Keelung at the present day volcanic agency is suspected to be at work under the sea. The water is occasionally covered with floating pumice, and the results of volcanic subaqueous movement have been noticed, especially during the earthquake of 1867. There are six sets of volcanic geysers in the district. During the earthquake mentioned the sea receded from Keelung harbour, leaving the anchorage quite dry, returning a few seconds after in two huge waves, sweeping away shipping, and destroying to a great extent Keelung and other towns close by, while even Tamsui suffered considerably.

Keelung is situated on the shores of a bay situated between Capes Foki and Petow, lying some 22 miles apart. The portion of North Formosa between these points receives the roll of the heavy sea of the north-east monsoon, though fairly sheltered during the south-west monsoon. In the bay is Keelung Island, a remarkable black rock rising precipitously on all sides, with a somewhat flat summit, 580 ft. in height. The harbour is easy of access, and fairly well sheltered from all except

the northerly winds, whose full force is felt. At present the depth of water in Keelung harbour is not sufficient for large ocean steamers to gain the requisite shelter from the north-east monsoon, owing to the accumulation of ballast which has for many years been thrown overboard by the junks. The bad weather often prevents cargo-boats from going alongside the steamers outside. The harbour might be improved by dredging, which has been proposed more than once, but it is more than doubtful whether the effect would be lasting. If the coal mines are ever to be of any great value or to turn out profitably, the water must be permanently deepened close to the town. The so-called harbour of Tamsui, "Freshwater" town, which is really only the lower reach of the Tamsui river, lies in a valley situated south of the high northernmost range, one of whose peaks stands 2800 ft. high over the harbour. To the south of this again is a double-peaked hill, with a summit 2000 ft. high. In the funnel-shaped entrance is a bar, with only 8 feet of water at low tide, and 7 feet to 12 feet rise during spring tide. The anchorage-ground, which is of shifting sand, is utterly insecure. The shore, next the mouth of the Tamsui river, is composed of low ground interspersed with sand-hills; on the south are sand and mud flats, stretching for some distance southwards; on the north a stony flat. Hu-wei, the town known to Europeans as Tamsui, is situated some two miles from the mouth of the river, just beyond the old Dutch red fort, which is now the British Consulate. The harbour is really formed by the debouchure of numerous streams rising in the mountains in various directions, and at distances varying from 20 to 70 miles from the mouth. The main branch comes from the south-east, but another important one rises in the north-east, in the immediate neighbourhood of Keelung, a few miles to the south on the southern side of the hill-pass, the upper reaches being set with fierce rapids. These streams flow towards Mangka, called also Bangka or Banca, where they form a junction some 15 miles from the sea, and into this they empty themselves. Large quantities of silt are brought down by the river, especially when swollen by heavy rains, the result being a troublesome bank in the middle of the river, and a narrow bar at the entrance on which the sea at times breaks with great violence. A dangerous surf rises with a fresh breeze, and vessels cannot count on entering—or, once within, on leaving—the port. In fine weather, and at high tide, coasting steamers of small draught can enter, but vessels of any considerable draught do not venture in on account of the insufficient depth and the surf-swell. The anchorage has shifted from the southern side, where it was within the memory of native residents, to the northern bank. This has been generally attributed to the wholesale deposit of ballast from junks in the river, never interfered with by the Chinese officials. In the south, Takow is the only port with a harbour which admits vessels of 12 feet draught. This harbour is formed by a small basin lying within a great placid lagoon, six miles in length and one to two in breadth, situated parallel to the sea. On the north it is bounded by a rich, flat plain, through which meanders a river,

and on the south is a low sand-bank, extending southward from Saracen Head, until it rejoins a continuation of the plain. On this is situated the village of Takow, with a population of about 1000. The entrance to the harbour is only 200 feet wide, lying next to and north of Saracen Head. A narrow ridge of sand runs from this point northwards, curving out, but generally parallel to the shore north of the entrance. Over the north and south parts there are 10 feet to 12 feet of water at low spring tides, but on the central portion not more than 7 feet or 9 feet. Its loose sands are constantly shifting, especially when freshets occur, and in the south-west monsoon, when wind and swell beat against the tides forcing their way seawards from the lagoon. In bad weather the sea breaks heavily on the bar. The anchorage is so confined that vessels cannot swing, and have to be moored head and stern, and a middle spit of sand further reduces the breadth of the anchorage, which is practicable only for small steamers. Trade is carried on from this place principally with Amoy. From Takow to Taiwan the distance is about 20 miles, the journey being performed either on foot, by chair, or on horseback. A telegraph line has united the two places since 1874, when it was erected by Chinese students who had been trained in the Foochow Dockyard School of Instruction. Owing to the surf so common at the Takow harbour, boats similar to those called catamarans are largely used. These are rafts of stout bamboos lashed together, the boatmen using the common Chinese paddle and a large sail, rigged in the ordinary way. The passengers are seated in a large tub placed in the centre of the raft-boat, which has surrounding it a slender-looking but strong bamboo railing. These unsafe-looking craft face the roughest swells thrown against the coast by the whole force of the south-west monsoon; yet accidents are not very common. In any case, they are the safest class of boat for the purpose required.

Approaching Takow from the sea, the prominent features in a very unattractive landscape are, on the left, Ape's Hill, 1100 feet high, with its barren, rugged sides rising with a steep slope from the sea. This hill, a block of coral, the summit of which resembles a crater, is believed to be an extinct volcano, which has been alternately submerged and upheaved. Farther south is Saracen, 173 feet high, a nearly level block, faced on the sea side by precipitous cliffs rising from the water's edge. Some 20 miles north of Takow is a straight line of beach, pierced by four small streams, and nothing noticeable appears until Fort Zealandia is reached, built by the Dutch in 1634 to guard the entrance of the then extensive lagoon-harbour of Taiwan-fu, the capital of the island. This open roadstead—known sometimes as the Anping Road, from the fishing village of that name which has sprung up round the ruins of the Dutch fort—has an anchorage of some six fathoms, but is situated next a series of flat sandy banks, on which the surf breaks heavily. These banks separate the roadstead from a shallow and muddy lagoon, next which is a low flat plain. During the north-east monsoon, from December to March, sheltered anchorage is found to the south-west of Fort Zealandia. But

this position is unsafe during the whole of the south-west monsoon; and when the monsoon is exerting its full strength no vessel can lie off the western Formosa coast, exposed to its full brunt. The bar is so dangerous that cargo-boats cannot pass it for days, and sometimes for weeks. The channel of the bar is constantly shifting here, as at Takow and Tamsui, and also, like those, shoaling rapidly. Good harbours existed formerly with 15 feet to 20 feet of water, where junks cannot now enter, and, according to Dutch records and Chinese testimony, the sea reached, at the time of the Dutch occupation, to the fort inside the city—that is, several miles farther inland. From June till September, trade at Anping is stopped, all goods being sent to Takow for shipment. The superintendent of the Imperial Chinese Customs and his staff are here, the British Consul and a medical missionary residing at Taiwan-fu. A mud plain, covered at high water, lies between the two places, communication being maintained by means of a small canal, by which flat-bottomed boats reach the city.

Since the time of the Dutch occupation, 250 years ago, the whole west coast has undergone great change. The harbours are silting up, and the coast is gradually, though slowly, undergoing a movement of upheaval. The earthquakes which have occurred—the worst of these being that of 1782, which lasted twelve hours, accompanied by terrible torrents of rain and tidal waves—have largely helped in effecting these changes. During the Dutch occupation, Anping was, as may be seen from the maps of that period, an island, while to-day it not only forms part of the mainland, but has a sand-bank stretching into the sea for several miles, on which the Chinese fishermen have built a village and temple. The western and northern harbours are therefore likely to present more and more difficulties as time goes on; and to keep the ports open, even for light-draught trading steamers, will be an expensive process.

For safe anchorage-ground for a fleet, it will be necessary to go to the Pescadores. Situated 25 miles west of Formosa, this group of islands has excellent harbours, the best being between Pang-hoo and Fisher Islands, the two largest of the cluster, which is less in extent than the Chusan group. There are 21 inhabited islands in all, of which Pang-hoo, the largest, is 84 miles in circumference. These islands have a barren look, owing to the want of sheltered valleys and the absence of trees. The population, about 8000, composed entirely of fisher people, is largely dependent upon the mainland and Formosa for food supplies.

The coast of Formosa is fairly well lit, there being lights maintained by the Imperial Chinese Customs at South Cape, Takow, Anping, and Keelung. There is also a light on the Pescadores.

When the ports of Formosa were thrown open by the treaty of 1860, little was known of the island except from the reports of the Chinese—the source from which the illustrious but unreliable geographer Klaproth drew his information. The Dutch did little to increase the store of knowledge about Formosa. The Chinese information was based, as usual, upon an

examination of things and men from a standpoint very different from that adopted by a Western critic, and we find in it little that is of any real value concerning the capabilities of the country and its inhabitants. Like all countries shrouded in mystery, Formosa was credited with fabled treasures of the earth, the field, and the forest. It was to be an El Dorado for the merchant and miner; but, as so often is the case, the results by no means justified the exaggerated expectations formed. Nor have the ports, opened to foreign trade about the same time as those on the mainland, justified even legitimate expectations. The foreign merchant in Formosa has found more difficulties to contend with than his *confrère* on the China coast. In China the inland waterways and canals offer channels ready-made, and existing markets await foreign supplies, for which they are ready to give native produce in exchange. In Formosa it was far otherwise; the merchant had to be a pioneer in the strictest sense of the word. Inland markets had to be created, communications were discovered to be almost non-existent, and only the western plain of the island was peopled, and that very partially, by Chinese settlers, the rest being occupied by natives, with whom the Chinese were in daily conflict. The administration, too, was less efficient than in China. The island is highly favoured by nature, but civilised man had succeeded in leaving his mark on but a very small portion of it. The opposition from the officials, then semi-independent, and from the gentry and village elders, the latter very powerful in Formosa, aided by the ignorance of a people chiefly agricultural, with few wants and no capital, formed a barrier more difficult to beat down than was to be found even in China. The increase in the territory occupied by the Chinese settlers, the process of absorption and extinction of the aborigines, steadily going on, and the enterprise of the Chinese traders are, however, working a change. Since 1874 reforms in the system of administration have led to a more effective government, and at present there is an able and vigorous administrator at the head of affairs there. In time, notwithstanding the initial difficulty which the dearth of good harbours presents, the trade of Formosa may be expected to largely increase, the main want being inland communications, roads and railways.

Let us see what the present capabilities of the island are in the way of trade. At Takow, between 1868 and 1883, the increase, in round numbers, was from £350,000 to £900,000; at Tamsui, from £280,000 to close on £1,000,000. The duties levied have increased from £35,000 to £80,000 at Tamsui, and from £40,000 to £55,000 at Takow; so that the trade in fifteen years has expanded threefold, while the duties have hardly doubled. The principal imports are cotton and woollen goods and opium, chiefly in the hands of foreigners. Both cotton and woollen manufactures find a ready sale among the aborigines and Chinese. There are no cloth manufactures of any importance in the island, except cloth of a rough texture almost unfit for use, and a sort of open grass cloth made by the savages. The practice of opium-smoking is unfortunately on the increase,

the savages having learned the habit from the Chinese with only too great alacrity. The use of the pipe is said to be a preservative against the deadly fever of the Formosan forests. The people prepare the opium, which is brought over to the island in the crude state, every village having a small boiling-shop. The poppy is as yet hardly cultivated in the island. Numerous small articles, chiefly for barter, such as bangles, brass-ware, isinglass, and so on, have been introduced, and a considerable trade in native produce is also carried on by Chinese traders from the mainland. As Formosa is capable of producing nearly all the articles now imported thence, the trade will probably before long change its character. The Customs returns unfortunately give no estimate of the junk-borne trade, which is important.

The chief exports of the island are coal from Keelung ; tea, which goes principally to America ; and camphor from Tamsui, together with sugar, indigo, hemp, and timber from Tamsui and the two southern ports. But the industries of Formosa are as yet hardly developed at all. This is principally owing, as we have seen, to the absence of interior communication, and to the dangerous navigation and bad anchorage on its coasts.

The export trade of the south is confined to sugar, turmeric, the fruit called lung-ngan, sesamum seed, ground-nuts, beans, bamboos for the production of canes and shoots, wheat, pith paper, pine-apples, and tobacco. Sugar forms over nine-tenths of the exports. The export of rice from the island, which at one time was so great as to earn for Formosa the title of "the granary of China," has dwindled down until it has almost ceased. This is to be accounted for by the fact that the improved communications along the China coast enable rice to be carried cheaper from Indo-China and Central China to the north and elsewhere.

It is unnecessary to say much regarding the coal mines of Keelung, the only production giving it any importance. At one time most extravagant estimates were formed of the value of Keelung as a centre of coal production and distribution. The coal exists, of fair quality, and can be turned out at the rate of \$5 to \$5½ per ton at Hong Kong, against \$6 to \$7 for Japanese, \$8 to \$9 for Australian, and \$8½ to \$11 for English. But Keelung coal will never be able to compete with the Tonquinese, Japanese, or Australian coal for the purpose of commerce. It is a small bituminous mineral, good for domestic purposes and for steamers making short passages, but for little else. It burns rapidly, cokes the furnace, and makes a large quantity of smoke, choking the tubes. The consumption is one-half greater than that of Welsh coal, one-quarter greater than that of Japanese coal, and its evaporating power 30 per cent. less, whilst the necessity for the frequent sweeping of the tubes causes loss of speed. As a self-productive coaling station Formosa has a distinct value for any naval power seeking to establish itself in these seas, and this was recognised by the French. The value of such a coaling station was well illustrated by the use made of Hong Kong by the French during the Tonquin campaign. But they who would hold Formosa will have to

defend it with forts, and a garrison will have to be left in a most unhealthy and dispiriting climate. Moreover, the harbour for the coal districts is very defective, and a naval depôt and harbour would have to be founded on the Pescadores. The native method of mining is exceedingly primitive and wasteful, horizontal tunnels being worked into the hill-sides, slightly inclined upwards to permit the egress of accumulated water. The orifices often are not larger than just sufficient to permit a man to crawl in and excavate small lumps of coal. Mining on the European method has of recent years been carried on under an English engineer, who, employed by the Chinese Government, has organised a proper system of working. Still the mines have not been worked as efficiently as they should be.

The trade in camphor, at one time very valuable, has dwindled down to small proportions. It was formerly in the hands of wealthy foreign firms; but in the early years after the Customs were established, it became a monopoly in the hands of the Taotai, the chief official in the island, who farmed it out to Chinese. These monopolists bought the camphor from the mandarin at \$16 the picul (33½ lbs.), and sold it at Hong Kong at \$28, for shipment to India, where it was largely in use for lubricating the body and for other domestic purposes. Camphor-wood, the gigantic laurel (*Laurus camphora*), is found throughout the whole mountainous interior occupied by the wild aborigines. At present it is only obtained from the narrow belt of debateable ground between the settlements of the Chinese and the territory of the aborigines, on which the Chinese settlers are pressing forward with unrelenting energy. The manufacture is attended with constant danger, from the native jealousy of the Chinese and of their encroachments. The camphor-tree has been the greatest incentive to the Chinese colonists to push forward. They enter into relations with the savages wherever they can gain or take permission to cut down the trees, and remove them to extract the camphor. Much of this valuable timber is wantonly or ignorantly wasted, it being no uncommon practice to burn large numbers of the trees to further felling operations. The devastation of the forests, however, is tending to the gradual settlement of the inland portions of the island by the Chinese. Other timber, but none of it valuable for the purposes of export, is plentiful in the inner hill-forests.

Tea is cultivated on steep hill-sides, or little terraces about three feet wide, each having only one row of plants. The shrubs seem to be nowhere grown on slopes immediately facing the sea, as the plant does not thrive under the influence of sea air. On the inner slopes of the first ranges next the sea it is grown extensively. The demand for tea has largely increased, and wider tracts of hill-country are daily put under cultivation. In 1883 there was an export of 13,500,000 lbs. The tea is not of a superfine quality, but it finds a ready market in America principally, and also in Australia. It has not a bad flavour, but the coarse preparation of the leaf and the faulty packing are disadvantages which will have to be overcome. The foreign merchants concerned in the tea

trade at Foochow have lately addressed a circular to the Chinese hong (firms) and growers, impressing on them the necessity for improvement, if they are to hold their own against Indian teas, and even against those in other parts of China. As the tea plantations are situated so close to the river and harbour at Tamsui, the industry is likely to increase. Tea has been tried on the east coast, but not successfully. No European has yet made tea-planting pay, nor can he be expected to compete with the Chinese middleman, who lives simply, works cheaply, and speaks the language in common use.

Grass-cloth fibre and jute are exported in small quantities. The first is exported to China to be woven into summer grass-cloth. Manufactured grass-cloth and other textile fabrics are sent to Formosa to be dyed with the fresh Formosan indigo, famed throughout China for its bright and durable tints. The northern districts produce indigo, which, packed in large tubs, is shipped in the liquid state, to Amoy and Shanghai principally. Rice or pith paper, the delicate substance so much in use by artificial flower-makers and painters, especially in the south of China, is exported in large quantities from Tamsui, where the pith of the *Aralia papyrifera*, is cut into sheets ready for the artist's brush. Petroleum is found a few miles south of Tamsui, and is said to resemble resin-oil more than the rock-oil of America or the Burmese earth-oil. In 1877 two Americans were engaged by the Chinese Government to work the petroleum wells, but they were hampered in their work—for in this, as in all similar undertakings, the management was Chinese—and a couple of years saw the entire collapse of the undertaking.

One of the valuable products of Formosa, at present undeveloped, is sulphur, the process of its manufacture being carried on by the Chinese in a very rough way.

The cultivation of sugar, the staple of southern Formosa, has acquired large proportions within the last few years. The sugar export represents 96 per cent. of the entire export trade of southern Formosa, and nearly 50 per cent. of the entire trade of the island. The coarse brown sugar which forms the greater part of the export is in demand not only in Europe, but also in Japan, as well as at Hong Kong and the various ports. It is somewhat similar in quality to the *taal* of the Philippines. Formosa might be made a large sugar-producing country, and the quality of the sugar might be greatly improved. The defects, as in tea and other industries, are due to the bad communications, and the faulty method of cultivation, owing to ignorance, want of capital, and absence of machinery. Though Formosa has very great disadvantages to cope with in its difficult and dangerous coast and navigation, still a large industry might be developed as has been done in face of similar difficulties in Barbadoes, with its rock-bound coast, open roadsteads, and absence of good harbours, very similar to the Formosan coast. The plodding perseverance, characteristic of the Chinese agriculturist in his own country, is apparent everywhere, but so also is the opposition to reform. Amongst other articles, turmeric

root, used as an aromatic and to produce a brilliant saffron dye, is exported. If permanence could be given to the colour, its value would be greatly enhanced. The ground-nut is largely grown, principally on account of the oil extracted from the seed.

Possessing so much that is favourable for agriculture—namely, a fertile soil, an equable climate, and an industrious population—Formosa has made considerable progress in developing its resources, so far as is possible with the very simple appliances and methods put in use by the Chinese. Enough, however, has been done to indicate the higher results possible by means of the improved and modern systems of Western nations. When these are brought to bear, aided by the introduction of numerous valuable economic plants, which the land is capable of supporting in addition to the kinds already in cultivation, the wealth and importance of Formosa as an agricultural country will be vastly increased. A considerable portion of the coast population live by fishing—the variety of fishes in the adjacent seas being very great—and by the cultivation of the oyster.

Although the native junk trade has in some measure decreased, owing to the introduction of the foreign steamer, still it is carried on with advantages which will long enable it to hold its own. This will be understood when the character of the voyages made to the mainland is explained. The distance is short, frequently occupying one day only; the winds are tolerably certain at fixed seasons; and the Formosan coast has many small harbours, with draught sufficient on their bars to admit junks where no steamer can enter. The working expenses are exceedingly small, the freights low, and the junks can afford to wait in port a long period for discharge and shipment. The greater portion of the trade is with Chinchew, a port situated a short distance north of Amoy. Occasional cargoes go to Foochow and Ningpoo. An important feature is the local coasting trade, carried on in junks of from 10 to 25 tons burthen. During the stormy winter months this entirely ceases; but for the greater part of the year a large trade is carried on between Tamsui and Keelung, and other ports on the west coast, as well as Sauo Bay on the east coast, in rice, camphor, sugar, and other produce, to be re-exported to the mainland. The piracy which existed until recent years along the coast has almost entirely ceased.

THE COLD LAKES OF NEW ZEALAND.

BY W. N. BLAIR, C.E.

THE Hot Lakes of New Zealand have been the theme of many a pen, from Jules Verne—graphic and entertaining, but weak as to facts—down to the Blue-Books of the Colonial Government, where the stern prose of veracity is the principal, if not the only, attraction. But the Cold

Lakes of New Zealand have received little attention at the hands of European writers. Lake Wakatipu has, however, been honoured by at least two distinguished writers—Anthony Trollope and Miss Isabella Bird. The famous novelist came in the depth of winter; the weather was not propitious and the roads were bad; and, although frankly acknowledging the amenities of the country, he as freely exercises the Englishman's privilege of grumbling. Miss Bird was more fortunate, alike in the season of the year, the weather, and the facilities for travelling. In her usual fearless, unembarrassed style she followed "unbeaten tracks," fraternised with saw-millers at the head of the lake, and entered into warm friendships with coach-drivers and others. But we looked in vain for her impressions; the only record she has given the world of her New Zealand trip is in the opening chapters of the *Hawaiian Archipelago*. Auckland is described in terms suggestive of abject somnolency, and the colony generally is designated as "Sleepy New Zealand." Any suggestion of this kind must of course be repudiated by every true colonist, and he can have no difficulty in making good his case, for the records of the Stock Exchange give abundant evidence that sleepiness is not our besetting sin.

The following notes are an attempt to give the people of the Home country an idea of those delightful regions at the other side of the globe, which may appropriately be called the New Highlands.

Except in contradistinction to the Hot Lakes of the North Island, and that the Maori name of the largest—Te Anau—is by some authorities supposed to signify "the water of the cold wind," the southern lakes of New Zealand have no special claim to the title given them here. They are not pre-eminently cold, and the climate of the lake district is one of the most enjoyable in the world. Truly Alpine, its leading characteristics all the year round are bright blue skies and a clear bracing atmosphere. The hot rays of the sun, concentrated into narrow valleys and reflected by polished rocks, and the cold winds from the snow-fields, modify and temper each other, summer and winter. Although the rainfall is considerable, the number of rainy days are few; and at the level of the lakes snow and frost are less severe, and remain a shorter time, than on the east coast of Scotland. The first winter passed at the Antipodes by the writer was spent on a road-surveying expedition in the Wakatipu district "under calico"—not a tent of thick canvas lined with woollen cloth, or otherwise made specially weather-proof, but an ordinary cotton "ten by eight," such as diggers carry about the country, with a "fly" or double roof to keep out the rain.

There are no hot lakes in the South or Middle Island, as it is indifferently called, and with the exception of those on the Hammer Plains, and a few less important ones in the same locality, there are no hot springs, and but few mineral waters. This is probably due to the fact that the volcanic formations are far less extensive than in the North Island. The hills that encircle the harbours of Dunedin and Lyttelton

are the only two places where eruptive rocks occur in appreciable quantities. But in the matter of ordinary cold lakes and mountain scenery the South Island holds the prior place. Besides a countless number of tarns, there are probably about sixty lakes of all sizes and shapes, from beautiful circles of liquid brilliants a mile across, to Te Anau, with its many fiords, covering 132 square miles. The lakes follow generally the main axis of the island, and a straight line could be drawn on the map running through eight of the largest, extending from Manapouri to Te Kapo, a distance of nearly 200 miles. There are also a few lakes at a lower level on both sides of the island; those on the eastern side are unimportant, but those on the west coast are very beautiful. Although the surrounding country is generally low and flat, it is densely wooded, and the luxuriance of the foliage can only be surpassed in the tropics. A distant background of snow-covered mountains is everywhere obtainable, and the reflections are said to be equal to anything in the far-famed Yosemite Valley. North of Mount Cook, where the Southern Alps form an unbroken chain, the mountain lakes are for the most part small, and they usually occupy lateral valleys leading to the passes. But in Otago, where there is no definite backbone to the island, they are more widely dispersed and of much greater extent. It is this part of the country that is commonly known as the Lake District. There are twelve principal lakes, arranged into four distinct groups; Hauroto, Poritiritiri, and Hakaporua, in the extreme south, are drained direct into Foveaux Straits by rivers of their own; but the other nine are divided into three river systems, each including three large lakes and several small ones. The northern or Canterbury group, drained by the Waitaki River, comprises the Te Kapo, Pukaki, and Ohau Lakes. The river is about twice the size of the Tay, five times the size of the Thames, and eleven times the size of the Clyde; and the lakes cover an area of 80 square miles. The central group, from whence the Clutha takes its supplies, consists of the Hawea, Wanaka, and Wakatipu Lakes, covering an area of 237 square miles, and feeding a river of greater volume than the Nile. The western group comprises the Te Anau, Manapouri, and Monowai Lakes, containing in the aggregate 193 square miles of surface, and drained by the Waiau, a river that discharges somewhat more water than the Waitaki. The three isolated lakes in the southern group cover an area of 44 square miles.

The northern group is situated in the Mackenzie Plain. So far as their size and immediate surroundings are concerned, these lakes are inferior to those of Otago. The Mackenzie Plain is an open undulating country, without much natural beauty, though at the same time a glorious view can be obtained at every point of the snow-clad Southern Alps and other ranges. The district is also interesting from a geological point of view, and on account of its proximity to Mount Cook, the centre of attraction in the Alpine scenery of New Zealand. The sentiment of the Italian proverb, "See Naples and die," is peculiarly

applicable to the monarch of southern mountains, for pen and pencil are alike powerless to depict its surpassing grandeur.

As seen from Braemar, Mount Cook is the termination of the long circle of the Ben Ohau range, a beautiful chain of rugged mountains, rising into a dozen peaks of every conceivable shape, from dome to spire. The peaks get higher and farther apart as they approach Mount Cook; but although surrounded by six or seven mountains over 8000 or 9000 feet high, it stands majestically alone, towering 12,350 feet above the sea. From some points of view, Mount Cook bears a close resemblance to the Aiguille du Dru, as given in the frontispiece to Professor Tyndall's book on the "Forms of Water."

The glorious spectacle of the mountains is not the only attraction in the neighbourhood, for here is established one of Nature's grandest workshops. A regular succession of machines—frost, sunshine, torrent, avalanche, and glacier—are incessantly at work converting the raw materials extracted from the clouds and quarried from the mountain scarp into the floods that swell the Waitaki, and the shingle and soil that make the Canterbury plains. "The mills of God grind slowly" is not true of the factory on Mount Cook, for the operations are carried on with an activity and clamour unattainable by human agencies.

According to Sir Julius Von Haast, the whole of the Mackenzie country was at some remote period the bed of a huge glacier, the largest planing machine ever employed in smoothing down the Britain of the south. This is obvious even to the unscientific visitor, for the tool-marks and chips are everywhere visible in scored boulders, stony hillocks, silt beds, and other morainic deposits, identically the same products as come from the mills still at work a little higher up among the mountains. The lakes are formed by moraines lying across the river-beds; and, in the case of Te Kapo and Pukaki, it is clear that the Godley and Tasman glaciers extended down to them at a comparatively recent period. The rivers spring direct from the glaciers full-grown: they have no childhood, no youth, no struggle for existence; they are born with the full vigour of manhood, and at once proceed in a bee-line to their destination, defying every obstacle. The whole course of the Tasman River, from the glacier to the lake, a distance of twenty-two miles, is perfectly straight; and there is only one slight bend in the Godley, which is of much the same length. These rivers are divided into numerous channels, looped and interlaced in an extraordinary manner. Seen from the neighbouring heights, they resemble those curiously reticulated pieces of organic fibre we sometimes see under a microscope. The glaciers that feed Lake Ohau are comparatively small; consequently its waters are clean and bright in cold weather; but the other two lakes are never clear, and as they are not large enough to be settling ponds, the water leaves them in a muddy state. It has a dirty bluish-green tinge, intensely cold, and rushes along in swirls and eddies. The lakes in the Mackenzie country appear to be silting up rapidly. The deltas at their heads are already four or five

miles long and increasing daily; so in course of time the Waitaki will have no means of purification, and it will roll down muddier and more mercilessly than ever.

The lower ends of the Godley and Tasman glaciers that feed the Te Kapo and Pukaki Lakes are respectively 3580 and 2450 feet above sea-level, the latter being the lowest glacier on the eastern side of the range. The altitudes of the lakes themselves are—Te Kapo, 2440; Pukaki, 1720; and Ohau, 1840 feet. The depths of the lakes are unknown, but they are believed to be comparatively shallow.

Mount Cook and its environs are pre-eminently the home of the Ice King, and the birthplace of glaciers. The glaciers of New Zealand have never been accurately mapped out;¹ but they are known to extend with more or less frequency from Earnslaw to the head-waters of the Waimakarira River, a distance of 200 miles. For ninety miles in the Waitaki and Rangitata watersheds the ice-field is almost continuous. The Rev. Mr. Green, who came all the way from England to scale Mount Cook, travelled over a glacier twice the size of any in the European Alps. Curiously enough the principal ice-field occurs at the narrowest part of the island. Whether this is a mere coincidence has not been explained.

There are five principal ice—or, as they are more commonly called, snow—rivers in New Zealand. These are the Clutha, Waitaki, Rangitata, Rakaia, and Waimakarira. The Clutha is trapped by immense lakes; it flows all the way through a mountainous country, with an average fall of 7 feet a mile, and has large tributaries all the way down; it is therefore wanting in many of the characteristics of a glacier river. The other four are very much alike; they are generally straight, and always rapid and muddy; they also in every instance flow over shingle banks near the source and mouth, and through rocky gorges in the middle. The average fall per mile from the glacier to the sea is as follows:—Waitaki, 21 feet; Rangitata, 50 feet; Rakaia, 40 feet; and Waimakarira, 45 feet.

The heaviest floods in the snow rivers always occur in summer, when the weather is hot and dry on the plains; and it is scarcely possible to conceive a more anomalous sight than the mighty river rolling down in high flood, and carrying destruction before it, while the country on both sides is parched with drought and panting for a drop of moisture.

The lakes in the central group are the best known in New Zealand, for there have been coach-roads to all of them for many years, and the railway has been open to Lake Wakatipu since 1878. It is not, however, the amenities of the scenery, but the thirst for gold that has opened up the country. The precious metal was first discovered in the Wakatipu district in 1862, and before many months had elapsed there were several steamers on the lake. Although steady and permanent, the gold-mining

¹ An exception must be made in the case of the Tasman and other glaciers in the immediate neighbourhood of Mount Cook. The author is apparently unaware of the maps appended to Professor von Lendenfeld's excellent monograph on the New Zealand Alps in No. 75 of *Petermann's Ergänzungshefte*.—ED. S. G. M.

industry is now comparatively small, and the district is dependent to a great extent on agriculture and the tourist traffic.

Hawea, the more northerly of the central lakes, is the smallest as well as the least interesting ; it is 19 miles long, 3 miles in its greatest breadth, and has an area of 48 square miles ; it stands 1060 feet above sea-level, and the general depth is from 910 to 1285 feet, running up to 450 feet near the ends. The scenery of Hawea is somewhat tamer than that of the other lakes in the central group ; the mountains on the western side and at the head are lofty and bold, but those on the eastern side are lower and more rounded, and the country at the foot presents a fine tract of flat agricultural land.

Wanaka, which at one point is less than two miles from Hawea, is 29 miles long, and from 1 to 3 miles broad, and has an area of 75 square miles. Its altitude is 970 feet, and its depth ranges from 600 to 1085 feet, the greater portion being upwards of 800 feet deep. The lake is long, narrow, and sinuous, but, at the foot, runs into arms and gulfs that extend over a circle of 9 miles in diameter. Land and water are intertwined in the most extraordinary way, like the parts of a child's puzzle. In this and other respects it closely resembles the lake of Lucerne in Switzerland. Wanaka is declared to be one of the finest lakes in the world. Comparing it with the other two most picturesque lakes in Otago, it may be said that Manapouri is remarkable for beauty, and Wakatipu for grandeur, but that Wanaka is both beautiful and grand. The scenery is diversified in the extreme : conical hills and islands, bushy ravines with rushing torrents, and towering mountains crowned with glistening snow-fields, combine to form a picture that is as difficult to imagine as to describe.

From the surface and shores of Lake Wanaka it is possible to see about thirty named and measured peaks, from 4000 to nearly 10,000 feet high, and a countless number that have neither been named nor measured. The general height is from 5000 to 7000 feet, but there are four or five peaks between the last-mentioned height and that of Mount Aspiring, 9940 feet. Aspiring, which may be called the Matterhorn of New Zealand, is the fourth highest mountain in Australasia. Although about 20 miles distant, it can be seen to perfection from the lake, for it constitutes the head of a wide, open, and flat valley, in which flows the Matukitiki river. All this part of the lake scenery is particularly impressive. Aspiring, Alta, and the Minarets are appropriately named ; the first two fully bear out what their names indicate, and the latter is decidedly suggestive of Oriental architecture. Alta and the Minarets rise sheer from the water's edge to an elevation of 7840 and 6440 feet respectively.

Wanaka has three beautiful islands, one of which is remarkable for having a small lake on the top, some hundreds of feet above the large one ; where the water comes from is a problem not easy to solve.

Wakatipu, the last lake in the central group, is probably the best known in New Zealand, being the favourite resort of tourists, who now visit it by excursion train in great numbers. The lake is 50 miles long,

and from 1 to 3 miles wide, and covers an area of 114 square miles. It stands at a level of 1050 feet above the sea, and is 1400 feet deep. In shape it is somewhat like an elongated letter S, and has a general resemblance to Lake Maggiore in the north of Italy. The outline of the shore is very regular, there being only two or three indentations that can be called bays. The scenery of Lake Wakatipu is very grand. The eye is wholly occupied with huge mountain masses and towering peaks, to the exclusion of anything that requires minute inspection. Lake Wakatipu is literally surrounded by a wall of mountains, and the gateways in the wall are few and narrow. Like the other lakes in the central group, Wakatipu has comparatively little forest; the flatter slopes are covered with fern, the common bracken of Scotland; for a few hundred feet after that comes the ordinary tussock grass of the country, which continues well up to the snow-line. The ledges in the steeper parts of the mountains are generally filled with evergreen shrubs, which make a fitting contrast to the sombre grey of the schist rocks, and the ravines and waterfalls are fringed with vegetation of the same kind.

From the deck of the steamer on the lake can be seen about forty well-known peaks from 4000 to upwards of 9000 feet high. There are seven over 8000, and the great majority of the remainder range from 5000 to 7000. Much of the charm of the Otago lake scenery is due to the facility with which it can be seen, and with which comparisons can be made between the various heights. The larger lakes in the European Alps lie outside the principal mountain masses, and frequently the best view of a peak is that got from a pass or spur half-way up; whereas in New Zealand the lakes wind in among and around the grandest mountains, and every height is easily measurable.

Commencing at the Kingston end of Lake Wakatipu, the mountains soon get bold and rugged, the Bay and Bayonet Peaks, and Mount Dick, on the western side, rise sheer and craggy from the water's edge. Although less steep at the base, the Remarkables, on the eastern side, is perhaps the most impregnable of the ramparts that surround the lake. It is comparatively straight and level, but closely serrated, and so steep at the top as hitherto to defy colonial climbers. The wall is buttressed in a very extraordinary manner by narrow rock spurs, the sides of which are too steep for snow to lie on; but as it lies on the intervening flat places, the winter aspect of the mountain is that of a curious mosaic in black and white. In the middle reach of the lake, there is a tolerably solid range on the northern side, but the mountains on the southern side are more or less isolated, and at one place there is a narrow valley leading to the Te Anau country. The finest scenery of all is at the head of the lake: there is no single peak so imposing as Mount Cook, but the general view is grand in the extreme, for the whole lake is guarded by a mighty array of mountains, whose predominant characteristic is massiveness. The centre-piece in the scene is Earnslaw, which may aptly be called the Mont Blanc of New Zealand, for in general appearance it closely resembles the monarch

of the European Alps; the only difference is that the latter is somewhat more rounded on the summit. One of the most prominent features of Earnslaw is an immense glacier that occupies a hollow at a high elevation on the mountain's side. At the end of winter it presents a smooth glassy appearance, like the frozen surface of a lake; but the movement over its sloping irregular bed in summer causes it to break up into huge steps, the front of each being the exposed edge of a crevasse. The glacier begins at the foot of a steep part of the mountain, and is jammed in between two spurs in a curious manner, so that the whole thing is not unlike a gigantic seat. A classical enthusiast has called it "Jove's Chair;" but we prefer the more homely comparison of the old Scotch lady, who said, "It is just like the 'Great White Throne.'"

There are three picturesque islands on Lake Wakatipu, about 7 miles from the head; they command the best view of the mountains, and are in consequence a favourite resort of picnic parties.

The glacier origin of the central lakes is commonly accepted, and in the case of Wakatipu it is apparent on every hand. The mountain slopes generally consist of small ledges, smooth and round, suggestive of the work of a machine that had a downward and forward motion. There are several glacier deposits along the shores, and the terminal moraine at Kingston is probably the most perfect in Otago. It stands about 250 feet above the present lake level, and extends about a mile and a half down the valley. The railway, which is made through the moraine, is laid out to follow one of the gullies that led the water from the glacier to the main river beyond. This is one of two unique experiences in railway making in New Zealand: the other is in Canterbury, where a tunnel is made through the wall of an ancient volcano, the harbour of Lyttelton being the crater. As the heavily freighted excursion train comes winding down the steep face of the moraine, with every brake screwed down, we may imagine the noise to be a microphonic reproduction of the crunching sound of the glacier, pushing forward a load that all the locomotives in Europe could not move, and the fanciful passenger in the Lyttelton tunnel may compare the engine's head-light to the spark that lit the original Plutonic fire.

As already stated, the depth of Lake Wakatipu is 1400 feet, but this is only in one place, the general depth being 1200 feet. The soundings are remarkably uniform, and there is no shallow water along the shore; the slopes of the mountains appear to continue right down to the bottom of the lake.

The central lakes are mainly supplied by rivers carrying glacier sediment; consequently, the water at their head is more or less muddy, but it leaves them quite pure: the large lakes act as settling basins, and otherwise purify the water in the most effectual manner. Unfortunately, the purity of the Clutha is not long retained; the diggers restore the sediment extracted by the lakes, and the river rolls down to the sea in a discoloured state all the year round.

The rivers at the heads of the lakes, like many others among the mountains, are remarkable for the sylvan beauty of their immediate surroundings. They flow through flat grassy valleys, divided into glades and parks by belts and clumps of bush, laid out by nature in a way that art can never excel. The bush is mostly black birch or beech, *Fagus solandri*, which in shape resembles the *Macrocarpa*; and isolated trees are frequently seen in positions that seem to have been specially selected by Nature's landscape gardener. The valley of the Route Burn has been compared with the policies of Taymouth Castle, but with an extensive background of magnificent Alpine scenery.

The Clutha is only 150 miles long, but it has a watershed of 8250 square miles, in which there is a heavy rainfall. As previously stated, the volume of water is very great. The river for the most part runs through rocky gorges; but, with the exception of a few miles near the Blue Mountains, the scenery is not striking. The most remarkable feature on its whole course is a succession of wonderful terraces that occur on the Wanaka branch; they are as smooth and regular as if set out and built by the hand of man, and in several instances the ends and corners have all the appearance of an immense railway embankment stopped in the middle—a record of financial collapse.

The western group of lakes is within 60 miles of a railway, and there is a good driving road all the way; but they are comparatively unknown, the ordinary tourist not having yet made their acquaintance. The reason is that the district is still unsettled, and there are in consequence no regular means of conveyance, and no proper accommodation at public-houses.

Te Anau, the most northerly of the western lakes, is the largest in the Middle Island. The main body of water, which extends due north and south, is 38 miles long, and from 1 to 6 miles broad; it has three arms or fiords running off from the western side and winding among the mountains, their dimensions being from 10 to 18 miles long, and from 1 to 3 miles broad. The lake covers an area of 132 square miles; it stands 700 feet above sea-level, and is from 720 to 940 feet deep. The country for 25 miles on the eastern shores of Te Anau is low and undulating, but the fiords and other portions of the lake partake more or less of the character of Wakatipu and Wanaka. Although not nearly so high, the mountains generally rise steeper from the water's edge, and, with the exception of some 15 miles of the low country just mentioned, there is a fringe of dense bush all round.

Te Anau has ten islands of various sizes and shapes, some of them being very picturesque.

Manapouri is of an indescribable shape and indefinite dimensions, being so cut up into bays, gulfs, and arms as to make it impossible to determine what is length or what is breadth. An idea of its size can, however, be obtained from the area, which is 50 square miles. The altitude is 610 feet; the depth has never been ascertained, but it must be very great, the bottom being supposed to descend considerably below sea-level, as in the

case of the other large lakes. Manapouri has five beautiful wooded islands that stretch across the lake near the foot, and constitute a prominent feature in the landscape; unlike much of the colonial nomenclature of localities, they have received euphonious and poetical, if not appropriate names:—Rona, Pomona, and others suggestive of Canute and Minna Troil. The lake is literally embossed in the mountains as a brilliant set in emeralds, with outer rings of rougher and darker gems, that change their colours with every mood of the sky. The islands as well as the mountain spurs rise abruptly from the water, frequently with a convex outline, a good idea of which is conveyed in the name of one of the headlands—"The Beehive"; above the level of the bush and the beehives the curve becomes concave, and the mountains rise tier upon tier, an amphitheatre of gigantic proportions. The general effect is of wondrous beauty and silent solemn grandeur. The same impression is made on the Maories, for the name of the lake can be translated into "sorrowing heart" or "dark influence;" evidently they consider it the abode of some deity who does not usually take a cheerful view of sublunary affairs.

Te Anau and Manapouri are only 5 miles apart, consequently the surrounding scenery is common to both. The lakes are guarded to the westward by irregular detachments of mountains, huddled promiscuously together like a badly trained army. They, however, show a good front, and sweep round the head of Te Anau and onwards to Wakatipu in a regular curve, like the circle of the Ben Ohau range in the Mackenzie country. There are some forty named and measured peaks in the vicinity, but they are considerably lower than those round the central lakes, the general height being only from 4000 to 5000 feet. The view from the shoulder of the Takatimos, an isolated range that bounds the Te Anau country on the south, is at once Alpine and sylvan. Mountains, lakes and rivers, forests, plains, and rolling downs, are brought together in a way that is seldom seen, and the picture will be still more complete a few years hence, when the low country is dotted over with cosy homesteads.

Monowai, the third of the western lakes, lies in a subsidiary valley about 16 miles from Manapouri, and 500 feet above sea-level; it is 14 miles long, and from half a mile to a mile broad, the area being 11 square miles. It curves round the end of a mountain range, and in shape resembles the boomerang of the Australian natives. Like the other lakes in the western wilds, Monowai is surrounded by rugged mountains fringed with bush, but there is an open valley nearly all the way from the river Waiau; consequently it is easy of access.

The vegetation of the western lake country is varied and profuse. It includes all sorts and conditions of plants, from the great red beech-tree, *Fagus fusca*, six feet in diameter, to "wee modest" flowers as delicate as the lily of the valley. With the exception of fuchsia and three or four others, all the trees and shrubs in the Middle Island are evergreen; but it does not follow that the woods are monotonous, for the foliage is of every

conceivable colour and tint, from the burnished green of the laurel to the rusty brown of the pepper tree and the silver grey of the *Olearia*.

Although not so apparent to the unscientific eye, geologists tell us that the western lakes, as well as those in the central group, have been formed by glacial action. Professor Hutton points out a large hill situated about eight miles down the valley as the terminal moraine of a huge glacier that had the whole of the Te Anau country for its lair. Possibly the scarcity of morainic deposits is due to the variety of formations that occur in the Waiau watershed. Rocks of all kinds are met with, from gneiss and schist, harder than basalt, to granular limestone as soft as chalk. One of the most interesting geological features is a series of immense terraces, four or five in number, that mark successive water levels. Relatively to the lakes, they occupy the same position as those on the upper Clutha.

The Waiau, which drains the western lakes, is one of the finest rivers in New Zealand: no part of it is uninteresting; and there are fresh beauties and new objects of interest at every turn. For a short distance below the lake the river flows as smoothly and slowly as a canal, but, after that, rocky gorges and shingle reaches alternate all the way to the sea. The average fall is 10 feet a mile, and there are no fords or bridges and few ferries.

The southern lakes have only been seen by explorers, and by but few of these. The first trustworthy map of the district bears the date of June 1883. The reason the lakes have been so long unknown is the inaccessible nature of the country. With the exception of the mountain tops, it is all covered with dense bush, in addition to which the low ground is swampy.

Hauroto, the largest of the southern lakes, lies 4 miles south-west from Lake Monowai. It is 21 miles long, and from three-quarters to a mile and a half broad, with an inlet 4 miles long and one and a half broad, the total area being $25\frac{1}{2}$ square miles. The lake winds among the mountains in long flat curves, the inlet being nearly detached by two islands that stretch across its mouth. The altitude of Hauroto is 610 feet, the same as Manapouri, and it is only 15 miles from the sea; consequently the river, which has never been traced out, must have large waterfalls, or be little more than a foaming torrent for its whole length.

Poutiritiri lies generally parallel with Hauroto, but 7 miles west from it, and much nearer Foveaux Straits, its lower end being only 6 miles from the sea. The lake is 18 miles long and of the same width as Hauroto; the area is $16\frac{1}{2}$ square miles, and the altitude 120 feet. In shape it is a reduced copy of Lake Wakatipu, with the bends stretched out flatter. The outline of the shore is exactly the same, being without indentations and otherwise quite regular.

The southern end of the South Island is known to the natives by a name which signifies "the last joint of the tail," and it would be equally applicable to Hakapoua, the third and last lake in the southern group, for

it is the most southerly one in New Zealand, and the most insignificant of the twelve herein described. It is only 4 miles long by half a mile wide, and stands at a low level, about 4 miles from the coast.

The southern lakes are situated among the mountains, like the others in Otago, but there is no high range between them and the sea. Thirty peaks in their immediate vicinity have been named and measured; they range from 3500 to 5000 feet high, but the great majority are under 4000. Beyond the fact that the mountains are rugged, the valleys swampy, and the woods damp and impenetrable, we have little information with reference to the country that surrounds the southern lakes.

This completes our description of the Cold Lakes of New Zealand. It is confined entirely to their physical aspect. They have no legendary or historical associations to commend them. Until the advent of the white men, thirty years ago, the country had no inhabitants. The Maories occasionally visited the interior on fishing and hunting expeditions, and in search of greenstone with which to make weapons and ornaments; but there was no fixed population. The only traditions, therefore, are the adventures by "flood and fell" of squatters looking for sheep country, diggers prospecting for gold, and surveyors spying out the land.

JOURNEY OF MESSRS. BROWNE AND O'DONNELL IN THE GAZA COUNTRY, EAST AFRICA.

[CONTRIBUTED.]

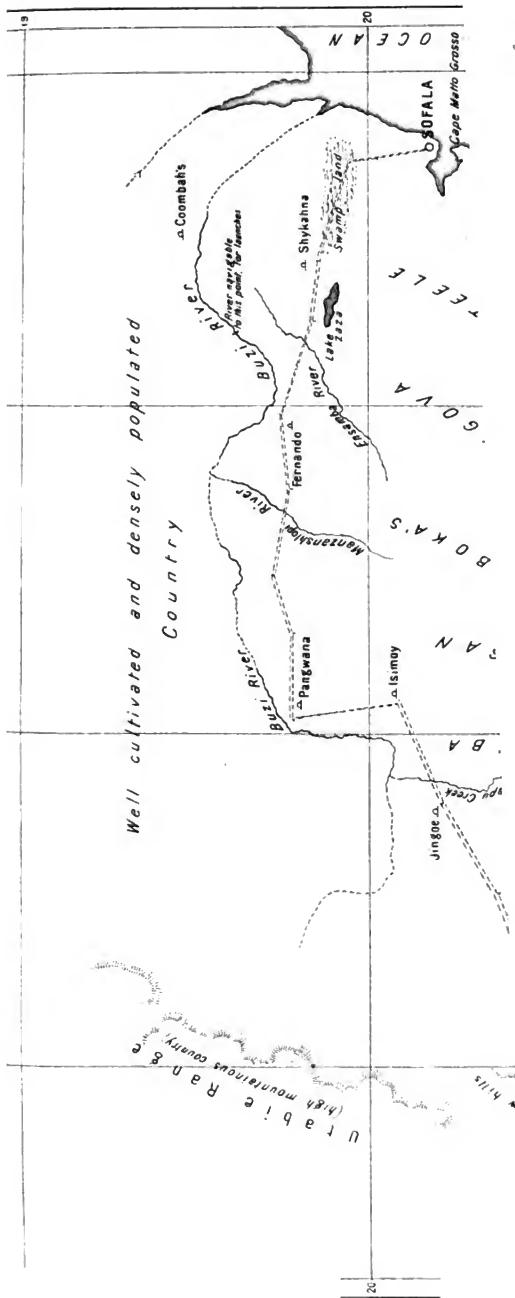
NEXT to the Transvaal and Swaziland, perhaps no portion of South Africa engages at this moment the attention of explorers and gold prospectors more than the Gaza and Mashona countries.

A strong halo of traditionary wealth still clings to these countries, which fired, and may be said to have fairly exhausted, Portuguese efforts at conquest and settlement in East Africa in the sixteenth and early part of the seventeenth centuries.

Despite the apparent exaggeration that colours most of the reports that reach the coast, of the auriferous wealth of this district of South Africa, gold-seekers are beginning again to find their way into it. English prospectors are now taking the place of the Portuguese adventurers and Jesuit friars who ranged the country gold-collecting and proselytising two centuries back.

It remains to be seen whether the Englishmen will be more successful than were the Portuguese in discovering gold in sufficient quantities to repay the cost and risk of gold-mining.

An interesting journey has just been concluded by two Englishmen, Messrs. R. W. Browne and A. O'Donnell, from Sofala into the heart of the Gaza country. These gentlemen, who have been working on behalf of a gold-prospecting syndicate, landed at Sofala in June last, taking with them



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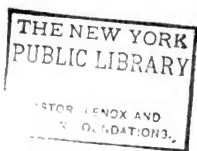
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a small party of natives from the Swazi country, and some presents for the native chief—Gungunhana, Umzeila's successor.

Mr. Browne reports the country about Sofala to be very swampy, and, even when the swamps are passed, the country preserves a low and monotonous character until the hills about the kraal of the chief are approached and the mountain range sighted (called the Utabie Mountains), the eastern slopes of which are drained by the northern tributaries of the Buzi River.

This mountain range evidently forms the outer edge of the great annular plateau bounding the Central African basin, which has only been crossed at this point by Erskine and Selous. By both of these explorers it has been described in very attractive colours. The latter speaks of it as a "high and open country, and very cold," rising to altitudes of 5000 and 7000 feet.

It is in the streams that drain this range, both northward and southward, that gold is washed by the natives, and to this country our South African explorers are now drawn.

The coast belt between the Zambesi and Sabi Rivers is, undoubtedly, very unhealthy in the rainy season, and our readers will not have forgotten the sad experience of Captain Phipson Wybrant's party near the mouth of the latter, and the death of three out of his party of five Europeans, in 1882. Messrs. Browne and O'Donnel, travelling in June and July, enjoyed perfect health however, and we do not hear that their horses suffered from attacks of the tsetse. Both were received very cordially at the kraal of the chief, who presented them with an ox every day of their stay, but they did not see him personally, and all negotiations as to prospecting the country were carried on through the chief Induna. After stopping ten days, Messrs. Browne and O'Donnel turned coastwards, striking the Buzi in longitude 34° E., and coming down the river, which they found perfectly navigable for light-draught boats from that point to the coast.

When stopping at Sofala, a most interesting, and perhaps a very important, discovery was made by them, of gold-dust in the sands of the sea-shore, within a short distance of the old Portuguese town. With the gold-dust were brought up also old coins and broken pottery, both from some depth.

Mr. Browne, who was formerly in the Royal Engineers, was unfortunately unable to take astronomical observations upon this journey, owing to an accident to his artificial horizon; but he has carefully measured and laid down his track by compass, and his former experience would enable him to do this with accuracy.

We reproduce the sketch-map sent by him, as it assigns to the hills about Gungunhana's kraal a very different position from that given in most maps, and makes their distance from the coast considerably greater. It also brings the main channel of the Buzi somewhat farther to the south. Messrs. Browne and O'Donnel reached the coast in safety in the beginning of August.

GEOGRAPHICAL NOTES.

EUROPE.

Heights of Mountains in Northern Europe.—Our Corresponding Member, Professor Mohn, of the Norwegian Meteorological Institute, sends us the following communication :—From the latest determinations, we find the altitude of the highest peaks in the countries bordering the Norwegian, the Greenland, and the Barents Sea, as follows :—

	Feet.	Mètres.
Galdhøpiggen, Southern Norway, ...	8,399	2560
Glitter Tind, ...	8,379	2554
Snehætten, ...	7,566	2306
Oræfajökull, Iceland, ...	6,427	1959
Sulitelma, Northern Norway, ...	6,178	1883
Petermann Spitze, East Greenland, ...	11,418	3480
Beerenberg, Jan Mayen, ...	8,350	2545
Mount Misery, Bear Island, ...	1,785	544
Hornsund Tind, Spitzbergen, ...	4,560	1390
Richthofen Mount, Franz-Joseph Land, ...	5,184	1580

Of these mountains two are volcanic, viz., Oræfajökull in Iceland and Beerenberg on Jan Mayen. The latter is described by Scoresby and the Norwegian North Atlantic Expedition as being some 6000 to 7000 feet high; but the members of the Austrian Polar Station, who wintered at Jan Mayen in 1882 to 1883, and made a thorough topographical survey of the island, found that the mountain—that is, the highest peak of the old crater rim—is considerably higher, viz., 8350 feet. The extinct volcano of Beerenberg is thus only 49 feet lower than Galdhøpiggen, the highest mountain of Norway, and only 29 feet lower than Glitter Tind, the next highest mountain of Norway. It rises nearly 800 feet above Snehætten, formerly regarded as the highest mountain in Norway. Beerenberg is more than 2000 feet higher than Sulitelma, the highest peak of Northern Norway, and 1923 feet higher than Oræfajökull, the highest mountain of Iceland. It is very interesting to observe that the volcanic region of Northern Europe—the Færoe Islands, Iceland, and Jan Mayen—has erected its highest monument on its northernmost point. Only seven miles from the northern shore of Beerenberg the sea attains a depth of 1040 fathoms or 6240 feet, and between Jan Mayen and Norway we have a depth of 2000 fathoms or 12,000 feet; between Greenland and Spitzbergen upwards of 2650 fathoms or 15,900 feet. The highest peak of the Arctic regions is found in East Greenland, where the Petermann Spitze reaches an altitude of some 11,400 feet. The northern groups of islands, Spitzbergen and Franz-Joseph Land, exhibit again elevations of some 5000 feet; and Mount Misery, on Bear (Cherry) Island, reaches only 1785 feet above the level of the sea.

Færoe Islands.—The largest of the group of 33 islands and islets known as the Færoe Islands, is called Strömö, its surface measuring about 29 miles long by 8 broad. The inhabitants of the archipelago number about 11,000, of whom about 1000 live in Thorshavn, the capital of the island of Strömö. The islands are nearly always enveloped in mists, generated by the meeting of the Gulf Stream with the cold Arctic waters. The chief article of commerce is fish; though wool is exported to some extent. There are no trees on the islands; timber for building purposes is imported from Norway. The houses of Thorshavn

are built of this material, and have roofs of birch-bark, covered with turf and grass. The streets of the little town are ugly and stony, and redolent of the odour of fish, fresh and drying, and of fish-oil. Another place of some note is Kirkebo, one of the oldest towns in the archipelago, and anciently the centre of a bishop's see and the seat of an ecclesiastical school. Whale-fishing in the season occupies many of the male inhabitants of the islands. The group, as is well known, belongs politically to Denmark.—*Soc. Roy. Belge de Géogr.*, July-August 1887.

ASIA.

Devil-Worshippers of Armenia: Lake of Urmia.—The grim designation of Devil-Worshippers is applied by the Nestorian Christians to certain communities scattered over Russian and Turkish Armenia, and down the valley of the Tigris, as far as the neighbourhood of Mosul. In the vicinity of this last-named, in the outlying hills of Kurdistan, lie Ba-Hasani, the sacred place of the Devil-Worshippers or Yesidis, which contains the temple and mausoleum of their Sheikh Adi, and, not far away, the village of Bashiyka, where their civil and ecclesiastical chief dwells. According to the tradition, their creed owes its origin to certain apostates from the Armenian Church, and their name is derived from Jesu or Jesid,¹ one of their chiefs. The creed had, however, probably a much earlier origin, owning as it does the influence of all the religions which have passed over the region indicated, from Zoroastrianism down to Islam. To the sun, at his uprise, they pay their orisons, and kiss the spot that is first touched by his beams. On certain solemn festivals they warm the fingers of their right hand at the flame of the sacred candle, then pass them over their right eyebrow, and kiss them. They call the Supreme Being Allah, and revere the founder of Islam as a prophet and Christ as a great angel, calling him Ben Isai Nurani (Jesus of the Light), who will one day come to rule the world. They desire to live on good terms with Shaitan, the Devil; and they entertain such a deep respect for him that they never venture to utter his name, but call him Melek-Taup, and worship him symbolically as a candlestick, and under the form of a bird. Our Thursday is their Sabbath. They fast for forty days in spring, but are not very strict in their observance; one member of a family being permitted to fast for himself and all the other members. Children are baptized immediately after birth, in the water of the holy spring at the grave of Sheikh Adi. For this purpose the water is carried about to places at a distance from the holy spring by mendicant priests (*kawal*), all of whom belong to one family. The alms collected by these functionaries on their mendicant journeys are divided in three proportions: one-half goes to the mausoleum of Sheikh Adi, one-fourth to the head of the sect, and the remaining one-fourth to the *kawal* himself. Besides these men, there are superior priests or sheikhs, and an inferior order of temple servants, the fakirs; and there is yet another class, called *Jirs* (Kurdish "old man"), held in great veneration by the faithful: they are invested with especial sanctity, from their saintly mode of life and their reputed power of healing. Eternal happiness can be acquired by the expenditure of sufficient wealth in alms to the priests. Circumcision is not strictly enforced, but left to the discretion of the head of the family. They have an antipathy to blue, and never wear any article of clothing which is of that colour. The Yesidis have the reputation of being strictly honest and moral, and show great respect for their women: indeed, the priestly dignity can

¹ The name has also been derived from the town of Yezl.—*Ed. S. G. M.*

be inherited by a woman. Polygamy is only allowed in the case of the tribal chieftain; the common people may have but one wife, whom, often enough, they have to purchase from her mother at a pretty high figure. The priests (*kawal*) may not marry outside of their own caste. A widow dresses herself in white; etiquette also prescribes that she should strew dust on her head, and stain her face with clay. Corpses are first washed, and then interred with the face towards the pole-star. In slaying animals all the blood is drawn from the body, after the custom of the Jews and Mohammedans. They cling to their creed with great tenacity, but refuse to receive any proselytes into their ranks.

The above particulars are condensed from an account of a journey undertaken by Herr Gustav Pauli from Tabriz to Van in November last, and published in *Mitteilungen* of the Geographical Society of Lübeck (Heft 11). The same paper contains much readable information about the manners and ways of living of the people through whose villages the writer passed, as well as numerous incidental facts of more strictly geographical importance. The route passed within a short distance of the Lake of Urmīya, which the traveller took the opportunity of visiting. He approached the lake at its north-eastern side, advancing through a marshy plain to its shore, which was covered with a black, ill-smelling mud. The only sign of life in the salt waters was a solitary young white flamingo. According to Vogt, the water of Lake Urmīya is constituted as follows: in 1000 parts there are 190.5 parts of chloride of sodium, 9.8 of sulphur compounds, and 5.2 of chloride of magnesium. No fish can live in it; no shell is ever washed to the shores; the only creatures inhabiting it are said to be certain small curious-shaped crustaceans. The maximum length of the lake is about 21 miles, its breadth 7; the depth is very slight; its surface lies 4080 feet above sea-level. The mountains stretch down to the water's edge at only a few points. The western side is fringed by an extensive plain, for the most part fertile. Towards the south, salt marshes and level steppes border the shores. Excluding the town of Urmīya, the plain of Urmīya is said to contain 20,000 inhabitants. According to a popular tradition, Zoroaster was born in Urmīya.

Siam.—The following is an abstract of a paper read by Mr. James M'Carthy at the British Association Meeting at Manchester, on 5th September 1887. The principal feature about the physical geography of Siam is its magnificent system of rivers; the most important stream being the Menam, on which river stands Bangkok, the capital of the country. About 100 miles from its mouth the river bifurcates; its branches both pass through richly cultivated regions, which grow large quantities of rice, and both have their banks well studded with villages. Besides Menam, the head of the Gulf of Siam receives two other streams of considerable size,—the Meklong, from the frontier range which separates Siam from Burmah, and the Bangpa-kong, from the Khorat plateau on the east. All these waterways are connected through canals, and are always swarming with boats and rafts. The country is inundated yearly, and upon this fact depends the success of the rice harvest. The north-eastern parts of the kingdom are also watered by the May-nam-kong or Mekong, the great river of Cambodia and Cochin China; but it is of little use for purposes of navigation, owing to its channel being impeded with rocks and cataracts. The surface of Siam proper is mostly flat, diversified by isolated hills and broken ridges of limestone mountains. But from behind Chiengmai, in the north-west of the country, two ranges of mountains branch off, one going almost due south through the Malay Peninsula as far as Singapore, parting Siam from Burmah, and having peaks 7000 feet above sea-level. The other range runs, generally speaking, parallel to the course of

the May-nam-kong until it enters Cambodia. Siam, lying roughly between 5° and 20° N. lat., has two seasons, depending upon the monsoons. The south-west monsoon is prevented from precipitating an excessive moisture over Siam by the intervention of the Burmo-Siamese frontier-range. During the last four months of the north-east monsoon (November to February), dry weather and cool breezes prevail. From the middle of February until June, when the rains set in, the heat is excessive, though at Bangkok the thermometer during this season seldom rises to 95°, and in winter occasionally falls as low as 60°. In the interior, however, 110° is sometimes registered in the hot season, and 45° in the cold. The average annual rainfall at Bangkok is about 67 inches, but in the interior must be considerably more. Malarial fever is a common complaint. Cholera is more prevalent in Lower than in Upper Siam. Small-pox is common in the Lao States towards the north. The chief articles of export are rice, cattle, sugar, pepper, cardamoms, and ivory, and from the Malay Peninsula tin, lead, gold, and indiarubber; the imports consist for the most part of machinery and Manchester goods. In the Lao country the chief agents of communication are elephants, bullocks, mules, donkeys, and carriers. The mules and donkeys come from Yun-nan, usually laden with opium. The porters mostly carry raw silk and "gum benjamin," which they exchange for European goods from Maulmein. A native tea is also an important article of local traffic. The inhabitants of the country, who are estimated to number about ten millions, comprise Siamese proper, Cambodians, Burmans, Annamites, Malays, and Chinese, besides the Lao tribes inhabiting the mountainous country to the north. The people are for the most part agricultural, and their towns generally consist of clusters of villages scattered along the banks of the rivers. The capital of the country, which has been continually shifted southwards with the southward march of the Siamese, has always been remarkable for the magnificence of its temples, and to this Bangkok, the ninth and present capital, forms no exception. Its population is estimated at between 300,000 and 800,000. Amongst the cities next in importance are Khorat, in the valley of the May-nam-kong, in a district famous for its gigantic ruins of stone temples; Chiangmai, on the Me-ping, the north-western branch of the Menam; and Luang-Prabang, on the May-nam-kong. Buddhism is the national religion. Every man in the kingdom, after attaining the age of twenty-one, must, for a short period at least, enter the priesthood. The present king is an enlightened sovereign, whose efforts are largely devoted to fostering amongst his people the results of modern European civilisation.

Some important work has been done recently by the Survey Department in the north and north-east, as shown by a map brought home by Mr. M'Carthy, especially in and beyond the province of Luang Prabang; the important and picturesque capital of this province has lately been destroyed by the "Black Flags."

AFRICA.

Emin Pasha in Monbuttu Country.—Emin Pasha has communicated to the Vienna Geographical Society a detailed account of his expedition into the land of the Monbuttu in the year 1883. Starting from Lado on May 7th, he proceeded in the first instance to Wandī, the principal town of the Makraka. In Lado, during the first week of May, the temperature had varied between 100°4 and 105°·8 Fahr. at noon; the minimum at night was 75°·2; and at nine o'clock in the morning the reading was generally 86°. The country around Wandī is inhabited by Makraka (Iddio), a race whose chief occupation is agriculture, and

the districts they cultivate have everywhere the prosperous look of gardens. Every three years they move to new soil. The configuration of the country is a gently-rolling plain, and somewhat monotonous in aspect, owing to the absence of forests. The soil is a heavy porous clay of a yellowish white colour, which refuses to retain the moisture. Farther south, beyond a village named Hokko, across the southern frontier of Makraka-land, the landscape acquires picturesqueness from several chains of hills, with naked blocks of granite and rounded gneissic detritus. The culminating ridges of the hills, consisting of enormous blocks of stone piled up one above another, are wholly destitute of vegetation; but wherever a rift or a cleft in their flanks retains a little soil, there the eye rests upon a patch of lovely green grass. Still farther south, between Moggu and Ndirfi, chains of small cones and isolated hills, with long connecting ridges, embrace small marshy depressions, mostly growing *Cyperaceæ* and sometimes papyrus. From Ndirfi, he turned west and north-west to the country of Abaka, where sorghum, earth-nuts, and tobacco are largely grown. Butterflies (*Pieris*, *Antiocharis*, *Colias*, *Lycæna*) were here remarkably abundant. The country which borders upon this, namely Mundu, has a reddish brown soil, resting upon a basis of abraded granite, and clothed with the broad-bladed grass (*Panicum*), the same which covers the west of Emin's province from 4° 30' N. lat. southwards, and extends to the east of the Nile into Unyoro and Uganda. This steppe land is watered by numerous currents of water, and slopes towards the south. The region, hilly with many marshy depressions, falls away gently towards the Akka, a tributary of the Dongu. From the country of Mundu, Emin Pasha passed on into that of the Southern Abukaya (lying south-west and west of Ndirfi). As seen from a hill in this district, the country rises to the north and west in broad terraces, crossed by chains of hills, whilst to the south and west extends an apparently unlimited steppe region, beribboned with lines of trees which mark the courses of the streams. The soil throughout these steppes or savannahs consists of vegetable detritus, covering a tough almost impermeable clay, which in turn rests upon the solid rock. Beyond this comes a firmer soil, a ferruginous clay, frequently hardened into conglomerates, and sprinkled with reddish quartz sand, and this again is succeeded by a whitish loamy soil consisting of vegetable ash, detritus, and soft humus. There one meets with nothing but marshes and depressions, where *Cyperaceæ* prevail; whilst the mud of the river channels nourishes *Anonium*, *Papyrus*, and *Polygonum*. The more hilly tracts sustain such forest trees as *Anona*, *Sarcocephalus*, *Zizyphus*, *Boschia*, *Grewia*, *Terminalia*, *Mimosa*, *Gardenia*, *Vitex*, but no palms. Animal life, except for small troops of antelopes, buffaloes, elephants, and a solitary rhinoceros or two, is not plentiful. The next important place reached was the station of Mundu on the river Dongu, whose broad channel at this part was interrupted by rocky islands and groups of large fragments of rock, and animated by crowds of hippopotami, by crocodiles, and by cormorants. The stream was flowing due west. In December it is said to be fordable on foot; but during the rainy season it inundates the surrounding country for a considerable distance. The region around Mundu is well cultivated, producing principally dhurra, squashes, sweet potatoes, *Gynandropsis*, tobacco, and maize. Here as in Abaka the favourite currency for trade are rudely shaped iron arrow-heads; indeed iron in any shape is greatly valued. The air was so heavily charged with moisture that the station was full of sick folk, suffering from catarrh, diarrhoea, and rheumatic fever. After crossing the little Bruhero, a tributary of the Dongu, Emin Pasha entered another marshy tract, gay with violet and white water-lilies nestling between beds of *Ottelia*, *Vallisneria*, *Potamogeton*, etc., and studded with groves of wild *Phœnix*

palms. A new plant was noticed, in its leaves and habitus not unlike the *Balsamina*, but growing to a height of 3 or 4 feet and bearing long spur-like flowers of a purple colour. The chief variety of birds was *Astrilda*. On approaching the country of the Niam-Niam, the marshy swamps gave place to tropical forests, filled with the music of the *Schizornis zonura* and the *Pogonorrhynchus*. The passage over the Dongu was made at a spot where the stream, flowing from south-south-east to the north-west, had a rapid current, and was 8 feet deep and 130 feet wide. Its banks, which were thickly planted with lofty trees, were composed of precipitous walls of a light-grey clay, mingled with violet-coloured vegetable detritus. Having crossed the river, Emin Pasha entered the country of the A-Sandeh. After crossing the Dongu by boat, Emin's march lay through a country which is cut up into rectangular patches, like the squares on a chess-board, by numerous little streams, tributaries of the Dongu and the Welle. Each of these water-courses is bordered by a belt of forest (*Calamus*, *Pandanus*, etc.), with a great profusion of floral growths. Some of these forest belts are practically huge landslips, often 60 or 70 feet deep, and choked with sunken forest trees. One of these streams, the Badungeno, forms the frontier line between the A-Sandeh (Niam-Niam) and the Monbuttu. The Welle, at the point where Emin Pasha struck it, lay in a basin about 50 feet below the level of its containing hills. The river was flowing north-westwards at the rate of 1150 yards an hour, with a current of 800 yards in breadth and $11\frac{1}{2}$ feet in depth. Its channel is perfectly free from islands and rapids, and deep holes; and its banks are lined with noble forests. The Monbuttu name for the river is Kibali, whilst the A-Sandeh call it Makua and Welle (=Great River.) From this river Enim marched first to Bellima, the village of chief Gambari, and then to Tingasi, the administrative centre of the Monbuttu country. The aspect of the region lying between the Welle and Bellima is, in its general features, almost the same as that between the Dongu and the Welle. But here the forests were decidedly more considerable, and every step taken revealed more and more peculiarities in the flora, whilst the vegetation became richer and more luxuriant. The marshy depressions, and the innumerable water-courses, in particular, were bordered with forest belts, proudly showing forth all the glory, beauty, and profusion of tropical vegetation: "magnificent copses of *Raphia* palms, the slender, delicately feathered fans of the *Calamus*, the large-leaved *Anonaceæ*, gigantic *Sterculiaceæ* and *Rubiaceæ*, a confusion of *Caladia*, *Philodendra*, *Amoma*, ferns, grotesque *Platyneria*, *Angræca*, and waving *Usmeæ*—all these constitute a scene of indescribable beauty." The almost incalculable fertility of the soil—a whitish clay preponderating—is borne witness to by the series of forest tree and banana plantations, patches of gigantic *Scitamineæ*, steppe glades, cultivated fields, huts, and sites of former settlements, which were passed in almost endless succession.

Keeping on in a south-easterly direction, the troop at length reached Bellima (2510 feet above sea-level), three-quarters of an hour north of the Gadda, in itself an insignificant tributary of the Kibali or Welle, but important on account of the great number of affluents which make it the recipient of their waters. The vicinity of Bellima is of extraordinary beauty; and the well-watered, well-drained country around is extremely fertile and productive, and supports a fairly dense population. The principal products of the fields are sweet potatoes, *Colocasia*, *Solanææ* (two varieties), various kinds of squashes (among them a peculiar species, from which oil is obtained), manioc, yams, *Helmia*, and excellent tobacco, as well as eleusine, maize, and bananas. After leaving Bellima, in order to save time, a path was cut through the midst of a dense forest, entailing

a most laborious and painful march through much mud and truly tropical vegetation. Then followed the steppe-land again, seamed with innumerable forest-belted marshy water-currents, until they come to the Nembe or Menembe, an affluent of the Gadda, 27 yards wide and $5\frac{1}{2}$ feet deep, with a multitude of anastomosing side-branches. Throughout nearly all this district the soil was red with ironstone. The next stream of importance was the Aelu, $6\frac{1}{2}$ feet deep, and with a channel 38 yards wide, but expanding to fully 88 yards with its network of side-branches. The contribution of water from such streams as this and a goodly number of others will explain the fact that the Gadda, which, not far from its source, is only some 20 yards wide, increases to a width of more than 50 yards just above its mouth.

Temperature Observations off the South-West Coast of Africa.—The following set of observations as to the temperature of the surface of the ocean were made by Herr Stapff, engineer, from the sailing-ship *Louis Alfred*, whilst on a voyage from Walfish Bay to Cape Town in the year 1886 :—

Date.	Hour.	Lat. S.	Long. E.	Sea-miles from shore.	Temp. of sea, C.	Wind.	Remarks.
April 28	2 30 P.M.	22° 53'	14° 27'	1 inside Pelican Pt.	14.9	SW. 1	
	3 0 P.M.	North of Pelican Pt.			14.4	0	Sharp division between the dirty green water of the bay and dark blue water of the ocean.
	6 0 P.M.	22 54	14 17	WSW. of Pel. Pt.	14.2	SW. 1	
" 29	8 0 A.M.	22 59	13 53	50	14.2	SSW. 1	Long low swell.
	5 30 P.M.	23 5	12 57	80	14.9		
" 30	8 30 A.M.	23 17	12 2	125	16.3	SW. 2	
	6 0 P.M.	23 30	11 19	165	18.6	SW.	Choppy sea; water of a deep aquamarine.
May 1	8 0 A.M.	23 53	10 18	220	18.4	S SW. 3	Long swell.
	6 0 P.M.	24 31	9 19	280	18.8		Choppy sea.
" 2	3 0 P.M.	26 14	7 18	400	19.7	SSE. 3	Even waves; water deep blue.
	7 0 P.M.	26 29	7 18	400	18.9		
" 3	8 20 A.M.	27 21	7 20	415	19.9	SSE. 2	Water ink-blue.
	5 30 P.M.	28 1	7 24	415	19.9		Sea somewhat broken; water an indigo blue colour.
" 4	8 0 A.M.	29 6	7 53	410	19.3	SE., almost calm.	Sea almost still.
	4 30 P.M.	29 37	7 41	410	18.9		Swell; water deep indigo blue. Sky partly clouded.
" 5	7 40 A.M.	30 21	7 55	420	18.5	NE. 2	Water muddy indigo blue. Sky partly clouded.
	5 30 P.M.	30 52	8 27	405	19.0	NW. 2	Water muddy indigo blue.
" 6	9 0 P.M.	31 54	9 45	380	19.1	W. 4	Water calm, dirty indigo blue. Sky wholly clouded.
	5 15 P.M.	32 22	10 26	360	18.5	NE. 4	Sea unsettled; water bluish-grey. Birds met.
" 7	6 0 P.M.	33 3	12 29	265	18.6	NE. 1	Sea calm; water dirty indigo blue. A gentle rain.
	9 8 0 A.M.	34 2	16 28	90	16.2	W. 4	High swell; water inky.
" 8	2 30 P.M.	34 4	17 7	55	16.1	N. 4	Fair weather.
	6 45 P.M.	34 2	7 23	40	17.2	WNW. 3	Water bluish-green; rainy.
" 10	7 0 A.M.	At anchor in Table Bay			18.1		Heavy swell from W.

On the 3d of January preceding, the same investigator carried out the following series of observations inside Walfish Bay. The greatest distance between the east and west shores of the bay is 4 miles 25 yards.

Hour.	Distance from E. shore.	Temperature of surface-water, C.	Hour.	Distance from E. shore.	Temperature of surface-water, C.
8 15 A.M.	55 yards	17.8	1 0 P.M.	6452 yards	15.7
8 40 "	952 "	17.4	1 15 "	4539 "	16.0
9 0 "	1695 "	16.3	1 30 "	2680 "	16.5
9 40 "	3281 "	16.0	1 45 "	3281 "	16.8
10 20 "	5031 "	15.4	1 55 "	on the shore.	21.0

At seven A.M. on the same day the temperature of the air was $15^{\circ}6$ C., and at one P.M. $19^{\circ}2$. The wind was N. 1-3. Herr Stapff adds, with reference to the temperature of the surface-water of the bay: "The cold current enters the bay round Pelican Point, and hugs the west shore. The water, after being warmed in the lagoon, then streams along the east shore and proceeds out into the ocean again."—*Annalen der Hydrographie*, Heft ix., 1887.

AMERICA.

Explorations in Greenland.—Lieutenant Bloch, of the Danish navy, writes from Upernivik, west coast of Greenland, under date 1st June 1887, to the *Nationaltidende* (Oct. 3) of Copenhagen, giving an account of a journey undertaken towards the north by himself and Lieutenant Ryder in the months of February and March preceding, and a description of the mode of life at that season in such a high latitude. The party set out from Upernivik on 21st February, with -40° Fahr. of cold, taking three sledges; and two days afterwards they reached Tasiusak. The object of the journey was principally to ascertain how far it was possible to advance towards the north during winter, and, if possible, communicate with the Greenlanders on the other side of Melville Glacier. At Tasiusak the number of sledges was increased to eight. With these they started again on the 25th towards Saitok, which they passed, and in the afternoon reached Itivdiardsuk. On the following morning the journey was resumed, in the course of which a cutting wind from the north was encountered. The next night was spent on a little island some four miles south of Wilcox Head. At this point they separated; whilst Lieutenant Bloch returned in order to go inland from Tasiusak to investigate the conditions of the inland ice, Lieutenant Ryder pushed on still farther towards the north. On the second day following, the latter explorer rounded Wilcox Head, and reached some islands a little north of Nugsak, in $74^{\circ}12'$ N. lat.; but there he felt compelled to turn back. As for his companion, Lieutenant Bloch, one of the expeditions he made from Tasiusak was to Giseke ice-fjord, the next largest, after that of Upernivik, in the region explored by these two gentlemen. On 14th March, at Tasiusak, the temperature rose to 23° Fahr., but on the following day it again fell back to $-38^{\circ}2$. In consequence of a heavy fall of snow which happened at this time, they were convinced that nothing could be accomplished so early in the season, and therefore returned to Upernivik. A second journey inland from this place in April (17th-26th) was more successful. At Kekertarsuak, a station of the summer before, five days were spent in observations on the movements of ice, and on the temperature of the ice "brae" and of the water at different depths. During this time the sun shone out every day in a perfectly cloudless

sky ; the earth began to be visible in places ; and whilst the minimum temperature in the early morning was $-27^{\circ}4$ to $-29^{\circ}2$, the thermometer rose to about -4° in the shade during the day.

Exploration in Alaska.—The *Montreal Gazette* announces that letters dated 29th July have been received from Dr. G. M. Dawson, who is in charge of the geological party exploring the Yukon district. The party constructed two boats on Dease Lake, and left on June 3d to descend the Dease River to its junction with the Liard. From that place Mr. M'Connell started with two men to descend the Liard. The remainder of the party, with five Indians, ascended the north fork of the Liard to Lake Francis, and, leaving their boats, crossed a long portage of sixty miles to Pelly River, near the abandoned Hudson's Bay port of Pellybanks, where they arrived on 29th July, all well. From this place the Indians were sent back, and Dr. Dawson, with Mr. M'Evoy and two white men, remained to construct a boat and descend the Pelly to its junction with the Yukon.

The country north of Dease Lake proved somewhat varied in structure, having a granite nucleus with Palæozoic rocks on its flanks, ranging from Cambrian to Carboniferous, and overlying Tertiary beds. The old portage was found to be entirely disused, and the party had to struggle through tangled woods, often knee-deep in moss. They got over, however, with a month's supply of provisions for the advancing party, and left stores for the returning Indians. Being north of latitude 60° , they enjoyed almost perpetual daylight, and the weather was good. The country is described as possessing well-grown trees, and a great number of the ordinary eastern plants were seen in flower, with some northern and western strangers ; only the great growth of sphagnum mosses, and the abundance of reindeer moss, give the country a different aspect from that of British Columbia. No Indians had been seen, except those the party brought with them from the coast. Though somewhat later in the season than he had expected to be, Dr. Dawson had hopes of reaching the coast before the freezing of the rivers, and the lines of section made by Mr. M'Connell and himself will give a good general idea of the structure and resources of the country.

Province of Santa Fé, Argentine Republic.—This province, which in 1869 ranked ninth in point of population, now takes the fifth place, following the provinces of Buenos Ayres, Cordoba, Entre Rios, and Corrientes. The census taken during the current year gave a total, in round numbers, of 216,000 inhabitants, as against 187,000 in 1882. Thirty years ago (1857) the population numbered only 41,260.

Chili : Two New Provinces.—By a decree of 12th March 1887, two new provinces were created, to bear the names of Malleco and Cautin. These provinces embrace the hitherto unorganised parts of Araucania, towards the south of the country, and are situated about the rivers Cautin and Lumoco, which unite their waters to form the Imperial River. The capital of Malleco is a place named Angol, with between 3000 and 4000 inhabitants. A place called Temonco, about the same size as Angol, has been selected as the administrative centre of Cautin.—*Roy. Soc. Belge de Géogr.*, July-August 1887.

AUSTRALASIA.

Royal Geographical Society of Australasia.—Some interesting information was given in regard to contemporary exploring operations, both in progress and projected, at the meeting of the Royal Geographical Society of Australasia

(Victoria) held on 9th August last. It was mentioned that a proposal had been made by the Government of Victoria to spend £5000 in assisting to send out two ships to explore the Antarctic lands south of where Sir James Ross's investigation terminated, provided the Imperial Government will vote a similar sum. Sir Allen Young has consented to take command of the expedition, and has promised to give £2000 towards its expenses. A cable message was daily expected from the Chancellor of the Exchequer, Mr. Goschen, as to whether the Imperial Government will comply with the request, and in the event of a favourable answer Sir Allen Young states that he will be prepared to start in six weeks from the date thereof. News from the Society's New Guinea expedition states that Mr. Cuthbertson has abandoned his intention to ascend Mount Owen Stanley, but will endeavour to reach the summit of Mount Oubr e. It was announced that a fund was being raised to enable Mr. Ernest Giles to undertake a further exploration into the unknown portion of central Australia, north-north-west of Lake Amadeus.

A paper was read by Mr. Edwin Merra at a recent meeting of the Geographical Society on the "Unknown Country." This described the characteristics of a large extent of Croajingolong, a country in the SE. of Victoria, which has been rarely, if ever, visited. Among the principal natural phenomena are the falls of the St. Patrick's River, about 200 feet in sheer depth, the great coast range of mountains extending from Mount Ellery eastward, which is entirely unexplored, and the Foaming Waters Gorge on the river Yerungunderah, a series of cascades falling from a height of 3000 feet through a dense grove of ferns. Mr. Merra described much of the land to be covered with thick and luxuriant forest, but in the flat parts there is abundance of thick black or chocolate soil, eminently suitable for cultivation.—*Communicated by Baron Ferdinand von M ller.*

West Australia.—In April last, Mr. J. R. Browne started from the little town of York (in $31^{\circ} 52'$ S. lat. and $116^{\circ} 46'$ E. long), the last station of the Eastern Railway, to explore the almost unknown country stretching between that point and Port Eucla, situated in $31^{\circ} 43'$ S. lat. and $128^{\circ} 52'$ E. long. His object is principally connected with a contemplated railway, intended to link the railway system of West Australia with that of South Australia.

Exploration in New Guinea.—Sir Henry Parkes, Premier of New South Wales, has consented to place at the disposal of Mr. Theodore Bevan a steam-launch for exploratory work in British New Guinea. Mr. Bevan's intention is to resume, about October next, exploration for a month or two, and, after the rainy season, to work on uninterruptedly for several months. His main desire is to trace to their source the large rivers recently discovered by the expedition under his leadership, and also to establish, with respect to those rivers, the German boundary. Mr. Bevan also proposes to map in the remaining *terra incognita* between the Fly and the Aird rivers. To aid him in his object, an influential committee has been formed.—*The Colonies and India*, Sept. 23, 1887.

GENERAL.

Classification of Lakes.—This subject is very suggestively discussed by Mr. W. M. Davis of Cambridge, Mass., in *Science* of 16th September. Several years ago he proposed a classification of lakes under three heads—Constructive, Destructive, and Obstructive—having reference to their mode of origin. Constructive lakes are such as were made by mountain-folding and other displace-

ments ; destructive lakes were chiefly basins of glacial erosion ; and the third category embraced lakes held up by lava, ice, and drift barriers, delta, and " oxbow " lakes, and some others. This classification he has now found to be unsatisfactory ; and in its place he proposes another, founded on the idea of connecting them with the different epochs in the life-history of a river system. When new land rises above the sea its drainage is at first generally imperfect ; lakes stand in the undrained depressions. Examples occur in Southern Florida. As time goes on, this sign of immaturity in the development of the river basin tends to pass away, the streams swell and cut down the restraining barriers, and the lakes begin to disappear. But the life of most rivers is so long that before they have time to exhaust all the lakes connected with them, mountain-growth again interferes with their development : their channels becomes obstructed, and lakes are formed again. Thus Lake Lucerne is a sign of rejuvenescence in the mature river Reuss. When a stream is at what may be termed its stage of adolescence, its head-waters often increase in number and size at such a rapid rate that the lower main channel becomes choked with silt, and its flood plain is built up so quickly that the smaller tributaries are unable to keep pace with it, and so, instead of augmenting its current, they form lakes, as those of the Red River of Louisiana, which are arranged like leaves on a stem. At the same stage in the growth of the river its slope through the flood plain is often so gentle that it winds round long curves ; when it cuts its way through the intervening space along the line of the bounding chord, a crescentic lake is formed along the line of the arc. In deltas " lakes often collect in the areas of less sedimentation between the divaricating channels." Again, in the drainage contest that goes on between head streams on opposite sides of a divide, the stream which loses ground " may have its diminished volume clogged by the fan-deltas of side branches further down its valley. Heim has explained the lakes of the Engadine in this way." On the other hand, the victorious stream may so greatly enlarge its volume, and thereby so quickly cut down its upper valley, that its lower course will be flooded with gravel and sand, and its weaker side-streams ponded back. Certain accidents to which rivers are subject are responsible for many lakes. " Accidents of the hot kind, as they may be called for elementary distinction, are seen in lava-flows, which build great dams across valleys : the marshes around the edge of the Snake River lava-sheets seem to be lakes of this sort, verging on extinction : crater lakes are associated with other forms of eruption. Accidents of the cold kind are the glacial invasions. During the presence of the ice, especially during its retreat, short-lived lakes are common about its margin. The rivers running from the ice-front, overloaded with sand and silt, filled up their valleys and ponded back their non-glacial side-streams. As the ice-sheet melts away, it discloses a surface on which the drift has been so irregularly accumulated that the new drainage is everywhere embarrassed, and lakes are for a time very numerous. Moreover, the erosion accomplished by the ice, especially near the centres of glaciation, must be held responsible for many, though by no means for most, of these lakes. Canada is the American type, and Finland the European, of land-surface in this condition."

The Régime of Estuaries.—Professor Osborne Reynolds read a paper on this subject to the Mechanical Science Section of the British Association at Manchester. He had been led by certain researches in hydrodynamics to investigate the manner in which flowing water transported loose sediment ; and from observation he passed to experiment. In a straight and uniform current of constant velocity sediment is transported as a uniform drift down stream, and its arrange-

ment is not altered. If the current is losing velocity it causes a depository drift, and raises the bed ; if, on the other hand, it be gaining velocity it produces a scour, and lowers the bed. When the current is curved the effect produced is to lower the bed on the convex and raise it on the concave side. The direction of the tidal currents in an estuary is determined mainly by the configuration of the shores ; and that the configuration of the shores of a stream is really a factor in producing sand-banks was proved by an extremely interesting piece of apparatus. Professor Reynolds made a topographical model of the Mersey, the bottom of which was flat, covered uniformly with fine sand. Water was poured in, and a series of mimic tides set up in it by an arrangement which could be maintained in action for several weeks at a time. After a few thousand tides, it was found that the uniform deposit of sand had been transported and heaped up in such a manner as to produce a series of sand-banks and channels closely corresponding in form and position to those actually found in the Mersey estuary. The conditions of experiment are not exactly similar to those in Nature, where other causes than the to-and-fro swing of the tides and the directive influence of the shores are at work ; but enough has been effected to encourage the hope that Professor Reynolds' future experiments will do much towards placing our knowledge of the origin of estuarine and fluvial structures on a more secure and satisfactory footing. So far, it would appear that by suitable operations rivers can be made not only to keep their own channels clear for navigation, but to pile up banks along the margins and reclaim tide-washed sands as dry ground.

Antarctic Exploration.—The question of a scientific expedition to explore the Southern Polar seas has been cordially taken up by the learned Societies of Australia, and it is hoped that the aid of the various Colonial Governments may be obtained in instituting a series of awards to shipmasters for short exploratory voyages. Such trips as are proposed by the Australian Societies cannot fully meet the need for a thorough investigation of the conditions of the Antarctic Regions. If they are carried out, however, much preliminary work may be done which will prove simply invaluable when the time comes for equipping that great British expedition which looms very faintly in the distance, but which will be despatched some day when the scientific authorities of the mother country fully realise the importance of this work. The plan of the Australian Societies, and the extensive support it has received, may be gathered from the following letters to Sir Erasmus Ommanney, by whose request we publish them :—

ROYAL SOCIETY OF VICTORIA,
VICTORIA STREET, MELBOURNE, 22d June 1887.

SIR,—The Councils of the Royal Society of Victoria, and of the Victorian Branch of the Royal Geographical Society of Australasia, desire to avail themselves of the opportunity which your annual meeting will afford them, to express to you the feeling of gratification with which they have learned that the British Association has decided to advocate a resumption of the work of Antarctic exploration. The Societies which we represent have for some time past felt the importance of reviving the noble project of investigating the physical condition of this vast and interesting region. With the object of promoting an expedition to the South Pole at the earliest date practicable, the two Societies above named have decided to act in concert, and in June 1886 they appointed a joint committee to deal with the matter. This joint committee has taken considerable pains to ascertain whether any unrecorded exploratory work has been done in this region above 60 degrees, in the hope that some of the whalers and sealers

who formerly frequented these waters might have—unknown to geographers, and in the pursuit of their calling—gone into the higher latitudes, and there have made observations which, if rescued from oblivion by timely inquiry, might prove to be both new and valuable. To our disappointment we have found that these seamen have, one and all, avoided the Antarctic. The rough seas which prevail between 40 and 55 degrees appear to be fatal to successful whaling within that zone, although fish are abundant. To the south of 55 degrees the weather is calm enough for fishing, but our whalers dared not cruise there on account of the ice, for their sailing-ships were unfortified, and our ship-owners, not having need of the stout-built and expensive class of steamship which sails to the Arctic for their fishery, were not enterprising enough to embark in an adventure which would necessitate their purchase.

After a very careful consideration of the conditions which surround exploratory work in the Frigid Zones, we have come to the following conclusions:—

1. That the cost of a purely scientific expedition is more than any colony would defray single-handed, though it would not be great for a rich nation to undertake.
2. But that the cost of a summer's dash into the Antarctic Circle ought to be within our means.
3. That such a trip from ports as adjacent to it as ours are, in a fortified steam-whaler, ought to give to the scientific staff on board the opportunity of acquiring a mass of information relative to the lands, seas, climates, magnetic conditions, the geology, and the commercial products of the region.
4. It might prepare the way for succeeding expeditions, by seeking for harbours suitable for wintering in.

As it is difficult to get Parliament to vote large sums of money for purposes which, being purely scientific, do not directly touch the constituencies, we have had to modify our project to interest the public in it. Fortunately for it, we have felt justified in pointing out to our fellow-colonists the fact that there is much evidence on record to prove that a very profitable whaling ground lies near to North Cape, Victoria Land, and that this belief needs only to be confirmed to create a new and profitable trade. Should these representations of ours produce the effect which we desire, we hope to despatch two steam-whalers to the Antarctic; and each vessel will carry some competent observers in addition to her crew. It would be a source of confidence upon which we should congratulate ourselves were the expedition to be under the command of an experienced Arctic navigator. We do not propose to charter these ships, as we believe that a judicious system of payment by bonus, by which owners and crew will be rewarded in proportion to the extent that new ground is broken, will do more to develop our knowledge of the region than will payment by any other plan. We append for your information this scheme, together with other papers. It will be seen that it is an extension to exploratory work of the principle of payment by result, long practised in the whale trade, and familiarly known to seamen as "the lay." Should you find it impossible to raise the funds you will need for a purely scientific expedition, we take the liberty of commending this course to you. In this age of utilitarian considerations, the combination of whaling and exploration under proper safeguards might render a scheme acceptable when a costly scientific expedition might fail to secure the necessary support. The plan has this further recommendation that the full cost is known from the start. Although we are hoping to get a Government grant, we can at this moment say no more than this, that our Premier, the Honourable Duncan

Gillies, has shown an interest in our proposals, and has been most courteous and obliging by allowing the Agent-General of the colony to act for us in London, and by granting other favours.

Turning away from the question of ways and means to that of the value of the work itself, the Victorian Societies feel warranted in recommending the renewal of Antarctic research, for the following reasons :—

- (a) That the configuration of the Antarctic Continent may be traced further, with the view to extend our acquaintance with the geography of the globe.
 - (b) That a further insight into the geology of these lands may be obtained.
 - (c) That it is desirable to increase the extent of the determined physiography of the world by ascertaining whether the recent volcanic disturbances in New Zealand and in the Sunda Islands, both situated on the line of weak earth-crust, which is believed to carry the volcanoes of Victoria Land, have produced changes of any kind in the Antarctic Circle.
- The examination of Mount Erebus would appear to be practicable, as Ross reports that the coast became lower as it trended towards its foot, and the results of a visit to the locality should be of the highest interest.
- (d) That the question whether any secular climatic change is in progress may be investigated, and that the sea temperatures may be ascertained by means of the most modern appliances.
 - (e) That the magnetic survey of these parts may be resumed, and that new data may be obtained for comparison with the elements recorded by Ross.
 - (f) That the existence of whales or seals, or the occurrence of any commercial products, may be accurately observed.

In considering the feasibility of the undertaking, it need hardly be pointed out that we now have the command of methods vastly superior to those which previous explorers employed. The handy steam-whaler will enable discoverers to make the utmost use of the open season, and the improved navigable balloon, devised for purposes of military reconnaissance, ought to prove a valuable auxiliary. In concluding this letter, we desire to express the hope that the efforts of your great Association, directed towards this grand object, may speedily receive the reward which they deserve. We sincerely trust the exploratory work in the Antarctic, commenced so well by the illustrious Cook, and continued by other brave seamen, but stayed ever since the return of that successful explorer and navigator, Ross, may be resumed at once with energy, intelligence, and ample appliances. Great Britain has great and glorious traditions to maintain in connection with geographical work. Her children, scattered over the colonies, expect that their mother country will vigorously sustain the noble national name. Long may our flag continue to be in the van, as well in the peaceful fields of scientific research and commercial pursuits as on the battle-field. As a school for seamanship none can equal the Arctic service; there is no healthier employment for the men themselves; and in the time of peace none is so sought after. If the question is to be discussed from the lower point of view of its cost, we do not hesitate to say that the project can more than hold its own as an investment of the public funds. We fearlessly express our opinion that the money which may be sunk in carrying out the enterprise will yield to the nation an ample return in a new whale-trade, that must follow upon a closer acquaintance with the region. Speaking for ourselves, we shall continue to keep the matter before the public here, and we shall do our best to educate the minds of our fellow-colonists in relation to the objects and value of Antarctic research. Should success crown your efforts, and Great Britain once more despatch an

expedition to the South Pole, we shall be delighted to aid it by any and every means within our reach. If the ships should touch at Melbourne *en route*, we can promise to their crews a hearty welcome. As a *point d'appui* for this enterprise our port stands unsurpassed by any in the southern hemisphere. While these are only our own sentiments, we know that they are largely shared in by the members of the various scientific Societies of Australasia. We have written to them to ask for their official permission to assure you of this; and in the course of the next few mails we expect to be able to supplement this letter with a list of the Societies which desire to join with us in wishing you a hearty God-speed in your labours in relation to this great scientific work.—I have the honour, etc.,

CRAWFORD PASCO, Captain, R.N., *President,*
Joint Committee of the Royal Society of Victoria and of the
Victorian Branch of the Royal Geographical Society of Australasia.

To Admiral SIR ERASMUS OMMANNEY, C.B., F.R.S.,
 Hon. Secretary to the Antarctic Committee of the
 Geographical Section of the British Association.

ROYAL SOCIETY OF VICTORIA,
 MELBOURNE, 25th July 1887.

SIR,—In accordance with the promise conveyed in the letter of 22d June from the President of the Antarctic Exploration Committee, forming an appeal of the learned Societies of Australasia to the British Association on behalf of Antarctic Exploration, I beg leave now to forward to you the names of those learned Societies in the adjacent colonies who have already signified their concurrence in the appeal, which had to be despatched in anticipation of their actual subscription thereto, in support of your contemplated enterprise:—The Royal Society of Tasmania; The New Zealand Institute, Wellington; The Canterbury Philosophical Institute; The Auckland Institute; The Otago Institute; The Royal Society of New South Wales; The Linnæan Society of New South Wales; The Royal Geographical Society of Australasia—New South Wales Branch, South Australian Branch, Queensland Branch; The Royal Society of South Australia; The Royal Society of Queensland. The President of the New Zealand Institute assures us of the sympathy of the Institutes of the different provinces of New Zealand, the members of which are also members of the New Zealand Institute, and whose direct sanction is expected daily, and will be notified when received.

We have not yet got a Parliamentary grant, but the budget is to be introduced on Tuesday next, and I hope soon to be able to report that one has been made.—I have, etc.,

H. K. RUSDEN,
Hon. Sec. A. A. Exploration Committee.

The above letters formed the basis of Sir Erasmus Ommanney's Report to the British Association at Manchester; and, although the reception accorded to it by that meeting was not very encouraging, we hope that the scientific Societies, especially those concerned with Geography and Meteorology, in this country will continue to urge on Government the important results to Science which must accrue from research within the Antarctic Circle. These, indeed, are too obvious to need insisting on; at the same time, it would be a mistake to minimise the difficulties of the undertaking. The absence of land, and the stormy nature of the climate, constitute conditions much more formidable than those which attend Arctic Exploration, and raise a doubt whether much would be accomplished by a "summer dash." Again, if a really valuable whaling or sealing ground exists, would not the hardy southern whalers have discovered it ere

now? And further, it may be doubted whether sufficient account has been taken of the probable secular movements, on a vast scale, of the ice-fields, which may have taken place since Ross's time, to an extent which would lessen the value of his observations as a base of operation.

MISCELLANEOUS.

A Chair of Geography has just been established at St. Petersburg University.

Asuncion, the capital of the State of Paraguay, has, according to the official census of 1st March 1887, a population of 24,838.

The first successful ascent of Mount Kilima-njaro has been accomplished by Dr. Meyer of Leipzig, who reached the crater of Kibo, which he estimated at nearly 6560 feet above the sea-level.

Captain van Gèle is about to undertake a new expedition in the region of the Upper Congo, his object being the solution of the Welle-Ubangi Problem. Each of these rivers has been travelled down or up throughout nearly its entire length. There still remains a stretch of about 66 miles between the nearest known points of both rivers in the same latitude. It is this interval that Captain van Gèle hopes to explore. He proceeds by the Itimbiri route, having started from Bangala on 1st July last in company with MM. Liénart and Dhanis.

NEW BOOKS.

Linguistic and Oriental Essays. Written from the Year 1847 to 1887.

Second Series. By ROBERT NEEDHAM CUST, LL.D. London: Trübner and Co., 1887. Pp. 548. Six Maps. (Oriental Series.)

As Honorary Secretary of the Royal Asiatic Society, member of the Bible and many Missionary Societies, and for a quarter of a century a distinguished member of the Bengal Civil Service, Dr. R. N. Cust has shown manifold capacity and energy. The outcome of his knowledge of affairs and scholarship we have in this second series of twenty-one essays, on subjects connected with India, Africa, Russia, Turkey, and Oceania. The last, on the languages of Oceania, anticipates a detailed volume, which is to form a companion to those on the languages of the East Indies and Africa. Dr. Cust is a philanthropist with crotchets, as well as a *savant*, but the sentiment which underlies all he writes is that of the wise treatment of the subject races intrusted to the empire of Great Britain. His remarks on caste, and the criticism of the administrative system of India by missionaries, are always worth attention, even when we least agree with him. The geographer will be especially interested in his essays on the origin of place-names in India, Russia on the Caspian Sea, Egypt and Palestine, the French North African Empire, and the Geographical Congress held at Venice in September 1881. The whole volume and its predecessor are most honourable alike to the experience and the scholarship of the author, on whom the University of Edinburgh recently conferred the degree of LL.D. Dr. Cust is at present travelling in Morocco, from whence he is sure to bring us a vivid narrative and wise criticism.

Dalmatia, the Quarnero, and Istria, with Cettigne in Montenegro, and the Island of Grado. By T. G. JACKSON, M.A., F.S.A., Honorary Fellow of Wadham College, Oxford; Architect; Author of *Modern Gothic Architecture*. 3 vols. Pp. xxvi + 418; vii + 397; viii + 453. Clarendon Press, Oxford. Price 42s.

These three magnificently printed volumes, which deserve to be taken as models of the perfection to which the typographer's art has been brought, deal less with the geography of the regions indicated than with their history, ecclesiology, architecture, and mediæval art. In respect of the latter subjects, Mr. Jackson says: "In the following pages I have endeavoured to give a tolerably complete description of all the architectural monuments of importance on the mainland of Dalmatia, the islands, the Croatian shore of the Quarnero, and the *litorale* of Istria from Pola to Aquileja. To this I have added an account of the island of Grado, which, though never, like Aquileja, part of Istria, is so intimately connected with Dalmatia as the metropolitan see of the Venetian dominion, that it naturally belongs to my subject." Mr. Jackson's archæological work seems, so far as we can judge, to have been exceptionally well done. He introduces us to many monumental remains belonging to both art and architecture which are not very well known to Englishmen, and to several which are not known to them at all. And his work in this connection has evidently been a labour of love.

The historical part of the work is not less deserving of commendation, and is evidently the result of great pains and severe investigations. For his materials the author has had recourse very largely to the works of the local historians, which often exist in manuscript only, and contain numerous valuable extracts from original documents. Judging from the able manner in which the history of the struggle between Venice and Hungary for the possession of Dalmatia is narrated, this book ought to be a valuable acquisition to the student who is interested in the history of Southern Europe. The summary account (vol. i. pp. 168-192) of the condition of Dalmatia under Venetian rule, from 1409 to 1797, may be mentioned as a type of sober, sensible historical criticism, written in a clear and elegant style.

The more strictly geographical work, apart from the blended narrative of travel and archæological description which runs all through the volumes, is limited to a brief account of the scenery and people of Dalmatia, and accounts of Montenegro and Trieste. The description of the scenery of Dalmatia is particularly vivid and charming; and much the same may be said of the account of Montenegro, early in the third volume.

From an editorial point of view, no pains have been spared, and no expense has been shirked by the publishers, to make these volumes attractive. They are well bound, and profusely illustrated with plates and cuts. "The illustrations are not confined to architectural subjects, but include several examples of church plate and silversmiths' work, in which Dalmatia is unusually rich, and also several general views of towns, which will give an idea of Dalmatian scenery." The work has two indexes, one of the illustrations and one of the general subject-matter, as well as a "chronological list of the inscriptions which are given in facsimile." In conclusion, we have two slight suggestions to make. The marginal notes, which are confined to the historical sections, should perhaps have been extended to the other parts of the work as well, both for the sake of symmetry and consistency, and on the ground of practical utility. The other point is of less importance. It is this: strings of names are sometimes printed

without being separated by commas—a practice to be deprecated, as tending to confusion. The map which accompanies vol. i. cannot be said to be up to the general level of artistic excellence which characterises the other art reproductions of the work.

Introduction to a Historical Geography of the British Colonies. By C. P. LUCAS, B.A. Oxford: Clarendon Press, 1887. Pp. 142. Index. Price 4s. 6d.

Mr. Lucas has commenced a work which promises to be one of some importance. In his first instalment of a *Historical Geography of the British Colonies*, he shows himself well equipped for the task; and we shall look forward with interest to the subsequent volumes dealing with the separate divisions of the Empire.

The present volume discusses (1) what a colony is; (2) the motives of colonisation; (3) climate and race; (4) modes of colonising, and kinds of colonists; (5) nations which have colonised, ancient and modern; (6) British colonisation; and (7) the changes in the British colonies during the nineteenth century. A series of eight useful maps illustrate the text, the arrangement of which is in every respect admirable.

The author shows evidence of a thorough mastery of his subject; his references indicate a comprehensive course of reading; and he places his material before the reader in a well digested, well balanced form. In discussing the colonising efforts of modern nations, we think he underrates the importance of the recent colonial acquisitions of Germany in Australasia and in Africa; and we do not think that France has shown herself as capable as Mr. Lucas maintains in her administration of the colonies she has founded. Mr. Lucas has made a distinct contribution to geographical science, and the dependence of historical events on geographical position is clearly shown in his pages. Read side by side with Dr. Freeman's *Historical Geography of Europe*, the student will find Mr. Lucas's book a valuable auxiliary by bringing up to date the colonial movements of European nations.

The Land of the Pharaohs, including a Sketch of Mount Sinai. By the Rev. SAMUEL MANNING, LL.D. Revised by Richard Lovett, M.A. The Religious Tract Society, London, 1887.

Egypt is always a theme of unfailing interest. The remarkable archaeological discoveries which have raised Egyptology to the level of a science; the recent identification of many Scriptural sites; the fact that it was the home of Euclid and the earlier mathematicians, as well as of Hellenic, as distinguished from Greek, philosophy, and of the celebrated medical school of Alexandria; its associations with the sojourn, sufferings, and final triumphs of the Israelites; and its long and stirring history, connect it indissolubly with the development of human civilisation. In the book before us, the author travels from Alexandria to Cairo; thence he sails up the mysterious Nile as far as Abu-Simbel. The monuments of the ancient greatness of the districts traversed by the author are carefully and lucidly described, while the scenery he passed through is in many places vividly and realistically portrayed. A good feature of the work is that the author avoids the ordinary chit-chat and trivial personal details of the ordinary tourist.

Interesting chapters on the recent discoveries in Egypt and on the Suez

Canal are given. But the chief merit of the work lies in the illustrations, which are, in our estimation, superior to the printed matter. Most of them are beautifully drawn, while in some the outlines must have been traced by a skilled artist. The general "get-up" of the work is all that can be desired, the binding good, and the type large and clear.

Zephyrus: A Holiday in Brazil and on the River Plate. With Illustrations.
By E. R. PEARCE EDGUMBE, LL.D. London: Chatto and Windus, 1887.
Pp. 237. Price 5s.

The author of this little book has turned a short holiday in the Brazils to considerable account, by preparing an attractive and useful volume of his travels. It differs from ordinary books of travel by the point of view taken up by the writer, who has sought to present the country to his readers from the economic and utilitarian point of view rather than from the view of the guide-book writer. His judgment is always sound, and his tastes artistic and varied; his style is picturesque, and sometimes characterised by originality and wit; the book is therefore to be recommended for its intrinsic merits, and it has been well produced by the publishers.

Life on the Congo. By the Rev. W. HOLMAN BENTLEY, of the Baptist Mission.
With an Introduction by the Rev. George Grenfell. London: The Religious Tract Society, 1887. Price 1s. 6d.

In the space of 126 pages, the author gives a pleasing and intelligent account of the social and physical conditions of life on the Congo; but his book is mainly concerned with the missions that are established in that part of Africa. Mr. Grenfell, the famous explorer of the Upper Congo, contributes a short Introduction. The illustrations are good, and the book would be well placed in the hands of young people.

Jenkinson's Practical Guide to the Isle of Man. By HENRY IRWIN JENKINSON. London: Edward Stanford. Price 5s.

This book is already becoming well known as the standard Guide to the Isle of Man, and we are glad to see a third, and revised, edition of it. The only material improvement we could suggest would be the addition of one or two large-scaled district maps, which are always appreciated by the tourist.

Tourists' Guide to Suffolk. By Dr. J. E. TAYLOR, F.L.S., F.G.S., etc. With a Map. Price 2s.

Tourists' Guide to the Wye and its Neighbourhood. By G. PHILLIPS BEVAN, F.S.S. With Maps and Plan. Price 2s.

Tourists' Guide to Wiltshire. By R. N. WORTH, F.G.S. With Map and Plan. Price 2s. London: Edward Stanford.

These are extremely handy little Guides; they contain all the information the tourist may require in regard to the districts to which they refer; and the authors appear to be familiar with the places and routes they describe.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

REPORT ON A JOURNEY FROM TUARAN TO KIAN, PROVINCE KEPPEL, AND ASCENT OF KINABALU MOUNTAIN, BORNEO.

BY R. M. LITTLE, ASSISTANT RESIDENT IN CHARGE, PROVINCE
KEPPEL, BRITISH NORTH BORNEO.

ON my return from a tour of inspection through the Ilanun districts, Pangeran Sahbudin, the chief of Tuaran-Sulaman District, reported to me that the headmen of the several countries around Kinabalu Mountain had been visited by Gawang, our Dusun sub-chief, and had signified their submission to this Government, but had made it a condition of their taking the oath of allegiance that I should personally visit them, and witness the usual ceremonies consequent on the above step.

As I had heard from Mr. Whitehead that his researches on North Bornean ornithology would bring him to the vicinity of Kinabalu, I determined to start with him to the interior; but circumstances prevented him keeping his appointment with me at Gaya Island, and later on, when he did arrive, I was away in Putatan, so we did not go together. I left for Tuaran on the 16th of February, arriving at the Government Station the next day.

Mr. Resident Davies had arranged for one of his local chiefs to meet me at Tampasuk; but although I waited two weeks for him the expected chief did not turn up. We were to have prospected together for an edible bird-nest cave, reported to be near Kinabalu.

In the meantime I took a walk to Madang village, on the Sugri Damit, a tributary of the Tuaran river. Here is the site of a fair, which was revived by the Government in 1885, and has ever since been well attended by Hill-Dusuns from the vicinity of the Tampasuk river, and

Bajans from Tuaran, Sulaman, and Mengkabong. *En route* I noticed quantities of the wild pine-apple growing on old cleared hills. On Bukit Tegás there are several specimens of the "gapas" (cotton plant). The plant here appears as a low straggling tree, bearing pointed berries three inches long. One bush averages a yield of $2\frac{3}{4}$ lb. of cotton.

Madang village is composed of two houses—one, the "Government Hotel," intended for the accommodation of the Hill natives, and the other Ahmat's house. This Ahmat is a Bisaya from Padas, whose acquaintance I made some four years ago in Papar. He followed the late Haji Jemuludin to Tuaran, and on the latter's death, bought his house and took a Dusun wife. Being slightly useful, he is now recognised as the local headman in the district, which is thinly populated, and in consequence easily governed. The temperature at Madang at 6 A.M. was 65° , height above sea level 143 feet.

On my return to the station I found a flat-bottomed "gobang" or dug-out awaiting me, which I had previously ordered. Length, 28 feet; breadth, $3\frac{1}{2}$ feet. This is intended to be used when the river is in flood or for shooting rapids.

I started for the interior on the 28th February, bringing up my baggage in the dug-out, and stopped at Telibong—a village situated on the left bank of the river Tuaran, just above the junction of the Telibong branch.

Next morning found me at Buntai fair, on the right bank of the Tuaran river, and forty minutes' walk from Telibong village. In ordinary weather the ford across the river is only thigh-deep. The fair is always well attended, and in spite of the recent floods over 500 natives had assembled, and they politely awaited my arrival to commence bartering their jungle produce—tobacco and cereals—for fish and dry goods brought by the coast tribes. Lampayan, headman of Kahong village, near Kinabalu, delivered me a message of greeting from Datoh Kabong of Kian, and was glad to hear I was starting at last.

We slept that night at Dumanker's house, near the fair. Our host, although a Dusun, has four wives and seven children, each wife contributing her quota of the latter. Buntai village at 6 A.M. Therm. 72° .

On the 2d March, at 10.55 A.M., we left Buntai village, and followed up the Tuaran river to its junction with the Bawang stream. We then travelled along the ridges which form the watershed on the true left side of this stream. This was the route taken by Mr. St. John in 1858 on his way to Kinabalu; and he has ably described the track to Sinilau village as being steep and slippery, and the climbing exceedingly warm work. We passed over Kanis and Tiwong Hills. On the latter, the stock of water brought up in bamboo joints was finished, but I was agreeably surprised to find out that bamboos, even when growing on hills devoid of springs, secrete, in their second or third joints from the ground, a quantity of pure cool water—a great boon to the thirsty traveller.

We arrived at Sinilau village at 2 P.M. This village possesses six

widely separated houses and two joint chiefs, Mah Tangaris and Mah Solongkod, who have paid poll-tax to the Government. They were absent until night in their padi fields. The houses here show me that I am at last in the interior and beyond coast civilisation, for they are dirty and infested with bugs; and every moment the howl of a dog indicates a too close proximity to the owner of a cooking pot, and pigs grunt harmoniously under the houses. Sinilau village at 4.45 A.M. Therm., 71°; height, 1248 feet above sea-level.

I numbered my coolies next morning, and found I had sixteen Dusuns, one Brunei Malay, and two Dyaks. The Government party consisted of myself, Pangeran Sahbudin, Clerk Usman, Gawang the Dusun sub-chief, and two privates of the B. N. B. Armed Constabulary. Each coolie had his sword or kris, and we had besides six Snider carbines, one smooth-bore No. 12 calibre, and one Spencer seven-shot repeater. Gawang carried the flag on a long spear, and an empty cartridge belt as a mark of distinction. I had engaged these coolies at nominal wages—15 cents per diem, and rations while marching, and 10 cents per diem when resting, the Dyaks getting 25 cents, and 10 cents with rations, as they represented the gun-bearers.

Our start was delayed by some bed-loving coolies, who were punished by getting the heaviest loads to carry. We had to walk up a steep incline before arriving at the flat ridge representing the top of Nilan Hill, 2226 feet above sea-level. Below, on the left of the path, the hills rising out of the mist resembled islands in a vast sea. Further on, we passed a large pond, at the foot of Tingkahang Hill, 40 yards in diameter, and from 3 to 4 feet deep. This, the natives say, is never dry, even in the longest droughts, owing to numerous springs. The pond resembles an old Roman camp, filled up with water. Tingkahang Hill is 1929 feet high. Passed the junction of an old path used by head-hunters before the cession. Manjok Sirong Hill, 2411 feet.

The hill leading up to Kalawat village is not so steep as its predecessors, and we arrived at 9.30 A.M., finding most of the men absent. The son of the headman Bajan, however, was there to welcome us, and before I left, he presented me with the usual stirrup-cup, a small bamboo of cocoanut toddy mixed with the bitter and intoxicating bark of the "rasak" tree. To procure this bark, the natives have to buy it at Buntai fair, from traders who obtain it at Papar.

We toiled up Kalawat Hill, at the back of the village, and found it a toilsome task. Were it not for the holes made in the paths by buffaloes' feet, on some of these hills, the coolies would be overbalanced by their loads; and to add to the task, the jungle has been cleared off, leaving ferns or grass only two or three feet high, and no protection against the sun. I was told Kalawat Hill was the last large hill between this and Kian, and I found this correct. Passed a "tubah" garden. Tubah is an intoxicating weed, which is mashed up in water, changing the latter to a milky-coloured fluid, and then poured into a stream. All the fish

within half a mile are quickly stupefied and easily caught. Despairing lovers sometimes use this weed to end their sorrows.

From Kalawat Hill we descended at a rattling pace to Tinnman stream, a tributary of the Mantaranau river at Bungol. Here we had a bath and cooked our rice. I had seen the men eating a semi-transparent fruit called "kandis," and followed suit. It had a pleasant acid taste at first, but afterwards my tongue and palate felt as if affected by a strong astringent. This unpleasant sensation lasted until night. After finishing the inevitable rice and tinned mutton, I went specimen-hunting, and succeeded in picking up conglomerate mixed with crystals, hornblende and quartz. Amongst the rapids, some Dusun had placed a fish-trap made of bamboo, but it was empty. One steep but small hill brought us to the banks of the Mantaranau river. We had to cross it and its tributaries several times. At 2.30 we arrived at Bungol. This village is built on the sides of a hollow which looks pretty, the grass having been grazed short. We took up our quarters in Banawa's house, it being large, and the headman Datoh Benawa being absent. But Bansayan said, "You cannot enter here," of which we took no notice until Gawang had arranged matters at Datoh Benawa's house, when we shifted, the culprit following and asking for pardon. At the Datoh's I met two men and two women who had just arrived from the Sindätun district, bringing tobacco for barter. Their village is one day's journey from Bungol, and the headman pays one buffalo as poll-tax this year.

I append a sketch of the whereabouts of Sindätun, as described by one of the men. The women wore stained rattan, and brass chain-work a foot broad around their substantial waists, and brass wire on their lower arm, which they only take off on becoming matrons. Their dress was a short indigo-dyed petticoat, reaching to the knee, and a similar cloth 14" by 4" across the bosom, sustained by a few coils of stained rattan. The men, as everywhere in the interior, wore only a dirty loin cloth. One of the men stated that all the villages on both sides of the Simalang river are disposed to join with Sindätun in tendering submission to Government. I intended to have visited this district, but was unable to carry out the whole of my programme.

Next day I walked up the Mantaranau, which passes through lawn-like valleys, bordered by low hills, and I certainly thought I should like to spend a week here, and amuse myself fishing, for the pools are full of the finny tribe, who were jumping at the flies in a systematic manner. This river joins the Kamulau river, at whose source is Kalausatan, the village of Gantok, the Tegäs chief. Kamulau river is a tributary of the Tuaran river, flowing in on its right bank between Linggah and Bayag villages.

In the evening I met the Rungus Maragang chiefs, and settled a blood feud. It appears that Kubud of Rambatuan informed these chiefs that Tapakawn village, near Madang, had not come under the Government (a falsehood), so they killed a certain man, Simpagawn, in retaliation for the

brutal murder, in 1884, of eighteen women and children, by Anakoda Radin, acting under Pangeran Kamaindra's orders, who was then Brunei agent in Tuaran. In consequence of the Rambatuan massacre, when we got the cession of Tuaran, Anakoda Radin (a Sarawak Dyak, who had left his country years ago) was wanted, but he fled to Mengkabong, and died there in 1885. Before the Rambatuan feud could be settled by us, these Rungus Maragang Dusuns retaliated, almost causing a fresh outburst of the feud.

Left Bungol on the 5th March in company with Datoh Benawa. Kampin Hill, beyond the second crossing of the Mantaranau, was terribly steep, but the Dusuns had thoughtfully cleared a path a fathom wide through the "lalang" grass. The height of the hill is 2363 feet. From the top of Kampin Hill, Kinabalu bore E. by S., Kian S.E. by E., and Pinokok E. by N. $\frac{1}{2}$ E. Descending its eastern slope was no easy matter owing to the steepness of the path, the soil being clay, covered with loose bits of sandstone. Even on the steepest places padi had been grown, and I cannot but admire the indifference to fatigue which would enable the local females to endure the consequent toil.

At the foot of the hill flows the upper waters of the Tampasuk river, locally called Sungei Kadamayan. Our path brought us to the side of a pool with a gravel bed, and here we halted to cook and bathe, and to collect specimens. From Bungol village to this ford we took 3 $\frac{1}{4}$ hours, the pace being slow. St. John mentions that his guide took him by a longer route occupying 8 hours.

Amongst the specimens we found were serpentine, granite, quartz, and hornblende, and in the sand bordering the stream I washed out a large quantity of mica, which at first greatly excited the natives.

The land on the right bank of the Tampasuk is flat, and is planted with padi and kladi. We met Lampayan, the headman of Kahong (spelt Koung by St. John), who led us to his village by a path which followed the river. A few minutes' walk brought us to Kahong, but Labong Labong village being only a little further on, we declined his hospitality. Kahong is built on a grassy sward, close to the river, on its right bank. To get to Labong Labong we had to cross the Kadamayan twice, and climb up a steep and slippery hill before arriving at the village. About 200 yards distant from the houses we had to climb over a stout bamboo fence, which I am told is intended to prevent the cattle straying, of which the people here have a goodly stock. At noon we were installed in Mah Tampulan's house, enjoying unlimited quantities of cocoanut toddy and water. Tampulan, the practical headman, for Mah Tampulan is getting old, arranged that each house in the village should provide food for two coolies; he himself attending to the leaders.

The name Mah Tampulan means "the father of Tampulan," from a custom common amongst the Hill-Dusuns, Ilanuns, and Sarawak Dyaks, who, when their sons are married, assume their name, adding the prefix. Mah is a contraction for Tamah, father—Tidih meaning mother. Mah

Tampulan informed me that Mr. Whitehead was staying at Melangkap, lower down the river, and was obtaining quantities of birds. We devoted the evening to hearing cases and examining into various reports of bird-nest caves. Three young women entertained us to some sweet singing called "juggans." The songs treated of love and courtship, and the allusions must have been amusing, for the men were constantly laughing; but I am told nothing improper was mentioned.

I wanted to purchase a tiger-cat's skin, but the owner would not part with it for two fathoms of black cloth, and for the benefit of future traders and travellers I declined to give more. The Hill-Dusuns are keen traders, and should one man give a high price for anything, the next man has probably to give still higher, or do without it.

It was arranged that Labong Labong village should give two buffaloes this year as poll-tax, and pay the regular amount next year. Bird-nest caves are reported to have been found in Kinabalu, facing Kian, at Kaporingan, and in the Labuk district at Kandasang village. It was arranged between Lampayan and Tampulan that a buffalo should be sacrificed on the morrow in honour of the treaty of friendship.

Next morning at 5.45 A.M. the thermometer registered 71°, the aneroid 1659 feet above sea-level. When Bunahow and Datoh Kabong, chiefs of Kian, arrived, we all adjourned to the village green, and found a young buffalo had been tied to a tree at the foot of a large boulder. The police and gun-bearers fell into position, and a volley was fired, the B. N. B. flag hoisted, and the local Tuaran flag (white ground, a red triangle with TUARAN in red below) presented to Tampulan. While Clerk Usman was cutting the buffalo's throat, a rectangular stone was planted upright in the turf, and Coast and Hill Dusuns laid their hands on the stone, swearing eternal friendship. Gawang states that he has visited sixty-four villages, and they all request a similar ceremony. In the evening we had some further talk about bird-nests. Datoh Kabong reports caves at Mumus Hill, but the natives of Bilawug stupidly eat the nests and do not allow outsiders to interfere.

We descended Labong Labong Hill to the junction of two streams, South Kinitakeh and Tahobang. Here we debated which way we should go, either by the Kadamayan river or over the hills to Kian. Finally the hill route was chosen. Datoh Kabong begged us not to drink of the Tahobang water, for this stream supplies water to Kian Nuloh, a section of Kian with whom he has a social quarrel. Should we persist in drinking, we certainly would suffer terribly, for on taking refreshments in his house the unfriendly waters would create discord inside us. The hill climbing was not severe, and *en route* we had a splendid view of Kinabalu.

Kian village is situated on Hangkong Hill, and divided into three sections—Upper, Middle, and Lower. The slopes around the houses are grazed by cattle and buffaloes; water is brought down by means of bamboo piping. At 6 A.M. the thermometer registered 70°, the aneroid

giving 27°·13, or 2635 feet above sea-level, as the height of Middle Kian. Datoh Kabong is the headman of the middle village, together with Baging: Bunahow owns the lower village. The upper village, Nuloh, I did not visit. Even Lower Kian is a long way above the Kadamayan, for the ground adjoining the river is only used for planting padi or vegetables.

I had brought *Life in the Forests of the Far East* with me, and occupied myself in translating parts of it to the Kian natives. My host was Datoh Kabong's relation, and was called Kulabid. Our quarters were in a house containing four doors, equivalent to accommodation for four families. My mattress as usual was laid on the sleeping dais, outside, in the passage, and this, having always windows close, was cool and airy. Round the foot of my bed sat the young women and chiefs, who eagerly examined my field-glass, illustrated books, and a few drawings I had made. H. S. King & Co.'s Illustrated Catalogue was in special demand. They even got leave to take it away to other houses to show their friends the jewellery section. I bought a gourd pan-pipe, similar to that used in Sarawak, for one fathom of black cloth, and found the notes to be very sweet, and a great contrast to a concert performed by a litter of pups in an adjoining bedroom.

The married women who have children to look after are marvellously dirty. As they do not wear the breast cloth, one is convinced that the curious custom of eating earth is not alone confined to Bajan women in a certain stage of their life, but applies equally to the Hill-Dusun baby, who, unlike Lord Chesterfield, seems to prefer to swallow his peck of dirt at one meal. The girls and childless wives wear the short petticoat and breast-cloth, but do not load their ankles with tinkling brass fetters like some of their coast sisters, but the brass chain work and rattan are worn round the waist. The men are comparatively clean, and shave their heads like the Islam native, a custom which is greatly to be commended.

We arranged to start next day for the bird-nest caves at the Kadamayan river. The meeting ended by the Hill-Dusuns going out to look for a suitable cow or buffalo to be sacrificed during the friendship ceremony. After numberless delays, the Kian chiefs succeeded in obtaining a goat, and at 5 P.M. the ceremony commenced.

Before the treaty stone was planted, I laid a cent in the hole intended for the stone. My servant handed me a Straits Settlements coin in place of a B. N. B. cent, but the mistake was not detected. Kinabalu was called upon to bear witness to the treaty. The sun, which had hitherto been hiding behind a bank of clouds, broke out, and all exclaimed, "A happy omen!"

The sunset that evening was lovely, showing all shades of gold and silver, and lighting up the purple mass of Kinabalu, which, towering overhead, reflected back the sinking sun from its crystal rocks.

The next day, 9th March, saw us getting ready for a start. Datoh Kabong and Bunahow promised to come down to Tuaran, but the former

said he was afraid of Orang Kaya Bladan, one of the Coast-Dusuns, who is a well-known swindler. At 10 A.M. we set off, leaving thirteen coolies behind, and descended to Bunahow's village, where we picked up that chief, who, however, was unacquainted with the position of the caves; but Lumbag, his aged follower, agreed to come after us on the next day and point them out. We descended again to the Kadamayan, and followed up its bed till we halted at a cave at the side of the river and had tiffin.

The bed of the stream is full of hornblende, granite, quartz, and limestone boulders, and we picked up numerous specimens containing copper or copper pyrites. Only a little further on we came to Mitunbok gorge, with an overhanging cliff, on the left bank of which we made our halting-place for the night—greatly to my disgust, for we were only a few miles distant from Kian; but Bunahow said he had agreed to wait here for Lumbag, the guide, and as there were two roads to the caves, he might miss him were we to go on. At 4 P.M. the thermometer registered 72°, and at 6 A.M. I ascertained the height to be 2651 feet, or only 16 feet above the village of Middle Kian.

Our beds were certainly not the most comfortable, as we had to lay the mats on gravel after removing the boulders, but a few wild plaintain leaves helped to alleviate the hardness, and conversation was limited, owing to the noise of the rapids only a few feet distant. The river rose slightly the next day, and I noticed that the flood-mark was a long way above our heads, but a hill with a tolerable slope a hundred yards distant would have afforded us a shelter against freshets. Although Lumbag promised to meet us in the morning, he did not arrive until 1 P.M., excusing his lateness by saying he was drunk. He certainly spoke the truth. When at Kian, the headman Datoh Kabong had promised to forward rice, which the carriers were to bring us next day, but mistrusting his promises I sent two parties back to hurry him up.

At 8.15 A.M. we started for the caves. Just before we left, Lumbag informed us that the road to the caves led to Kinabalu. I had previously been told at Kian that to ascend Kinabalu necessitated returning to the village, and in consequence had only provided for two days' tramp, as also had the men, but we determined to push on and lose no more time. We followed the river up for half-a-mile, and turned up the right bank. The almost obliterated path led us up a hill-side, very steep, and so slippery that, had it not been for the numerous roots which we were able to haul on in getting up, I think we should have been obliged to look for another path.

On reaching the hill-top we followed the track along the ridges in an E.N.E. direction. At 9.20 A.M. the aneroid registered 3482 feet, thermometer 74°; at 10.45 A.M. thermometer 70°, aneroid 4806 feet; at 11.26 A.M. 72° and 5228 feet. Looking at the Kadamayan we saw a waterfall. St. John describes it as follows: "At one place we had a view of a magnificent cascade. . . . The stream coming to the edge of the precipice, throws itself over, and in its descent of above 1500 feet, appears to dif-

fuse itself in foam ere it is in the depths of the dark wooded ravines below." I stood on a projecting root, and examined this noble fall through my field-glass, but could only see a portion of the descending water, and cannot therefore say what the height may be, owing to the spray and mist, but I think it worthy to be called Regina Falls, in honour of her well-beloved Majesty. The path at this point was only a foot broad; on either side were sheer precipices.

At 12.5 P.M. the rain fell heavily, but after each man had eaten a biscuit we plodded on. From here the path began to descend towards E.S.E., and we had to pass along the face of a sloping rock, down which the rain-water was running. Some moss growing on the rocks afforded a precarious foothold, but so fragile that, on hearing some one behind me slip, I could not turn round to see who it was. It turned out to be the Brunei Malay, Pangeran Baker, and without doubt he had cause to congratulate himself on a narrow escape.

At 2 P.M. the men begged me to halt, as they could not stand the cold any longer, so, choosing a flat spot, my tent was unpacked, and erected horizontally. It accommodated the whole of our party, twenty-six in all. Our first attempts to obtain fire were unsuccessful owing to the wood being wet, but, with the help of kerosine oil, we soon had half-a-dozen fires going. The Dyaks reported having seen Tiong Tuan from the "slippery rock," and I found that we had arrived at the caves at last, as the river Kadamayan was only 100 yards distant.

I awoke at 2.45 A.M., and found the thermometer registered 59°. At half-past-five I walked to the river and saw above me a small cascade 70 feet high, and to its left, the entrance to two caves. A few swallows were flying out, but these, Pangeran Sahbudin said, were not the "cave-swallows." Nanggai and Rajib tried to climb up, but a log, which they would have had to cross, was too fragile, and we deferred the search until ropes of rattan could be made. I sent back Gawang, Bunahow, Dato Benawa, and two coolies to hurry up Mapadri, who was to bring the rice to Tamborongah, the next stage. We then commenced making ropes with the "jauggut" rattan, a pretty species about the thickness of a drawing-pencil. When the rope was finished we found that owing to a small precipice above the bank of the river, another rope five fathoms long was necessary. Some of the men cut sticks, and laid them on a frame, so as to form bed-places for us all. As usual, rain fell after noon, but this time we were under cover. The caves were examined next morning by Rajib, and proved to be simply shallow holes, inhabited by bats and swallows.

At 10 A.M. we started for Tamborongah. Our guide Lumbag led us through the jungle by an imaginary path up and down hills, crossing the Kadamayan and sundry small streams. At 12.55 we emerged from the jungle, and had a good view of the surroundings from the crest of a hill 6077 feet high. Gawang and his party were observed toiling up the hill below us, so we hurried on, and ten minutes after arrived at Tamborongah. This may have been, ages ago the site of a mountain village, but at the

present day there are only two small huts, usually called "Sulaps," without walls, and thatched with leaves. The thermometer registered 55°. As the rain had just stopped, my followers were wet, and paralysed with the cold, so I had myself to make a well to receive the tiny rivulet which oozed out of a marsh close at hand.

Gawang, stupid Gawang, had only brought up about twenty-five catties of rice, and only four small rolls of tobacco. We had been two days without tobacco, and naturally *blessed* him and his coolies heartily. It simply meant partial starvation, for this rice had to provide us with our only meal this day, one to-morrow, and one the next day, or else to return. I here take the opportunity of stating that the Tuaran Dusuns are superior to their neighbours, for they never even grumbled once at the commissariat, which department was woefully defective, and, although they were half starved, always carried their loads manfully, and never suggested a retreat. Gawang had also brought up a white fowl and a few paltry brass goods, intended as propitiatory offerings to the spirits on Kinabalu.

When we arrive at Paka Paka cave to-morrow we are not to mention the word "Kinabalu" or "Kerbau" (buffalo), or wish for sunshine, for if we do, it will anger those mighty spirits, and punishment will follow in the shape of torrents of rain, and, if we spread out cloths, a violent gust of wind will be the result.

Next morning I took several compass-bearings. Mannkan Island near Gaya was W. $\frac{1}{2}$ S., Kuala Mengkabong W. by N. Thermometer 56°, height of Tamborongah 7328 feet.

Started at 7.40 A.M. by a fair path, compared to yesterday's. The old guide and three coolies left us to return to Kian, and bring up more rice, and await our return at Tamborongah. We passed several places covered with ferns, from which a good view might have been obtainable, had the mist cleared. The air was very cold, and I wore my waterproof coat, and kept it on for a long way up. A short way above, the path crossed a marshy spot, but I did not notice the tracks of any beast near. In fact, life seems to be non-existent in these high-growing jungles, for during the whole trip from Mitimbok gorge to the top and back, our party only saw two birds, a species of starling and a swallow.

I have forgotten to describe the splendid pitcher plants and pretty blue and white flowers which we passed, and, what pleased my eye better, I must confess, the quantities of large gutta-percha trees and rattans. The latter were rather too plentiful, especially the thorny rattan (Malay hing), and our hands bore traces of them for more than a week afterwards. I imagine the thorns are poisonous.

We had no cliff-climbing to do to-day, but had to be careful in picking our steps, for the moss-covered roots offered a treacherous foothold at best, and when walking quick, a leg would disappear up to the thigh in some hole. The moss up here is of different shades of crimson, and retains a quantity of ice-cold moisture; 9000 feet or thereabouts appears

to be the highest limit reached by the rattan, either the marketable or thorny species.

Dilana Hill (or it may be spelt, according to the Dusun rules of syntax, "Da Lana," that is, Lana with the article *da*) is a much more important hill than Kinabalu, for on its eastern side are the sources of the Sugut and Labuk rivers. The path led us over the top, and I ascertained the height to be 9700 feet, and taking the length of the former river at 130 miles, this gives a fall of 1 in 70, which will equally apply to the Labuk river.

The Sugut river allows even heavily laden dug-outs to be poled up as far as Langsat, 105 miles by water from its mouth. I therefore hope on a future journey to the *east* side of Kinabalu to be able to give an impetus to the already large export trade in jungle produce which leaves that river, and in a lesser amount the Labuk.

We then descended into a hollow, but soon had to climb up the true "trunk" of Kinabalu, as the natives say. Almost on a level with Dilana top, I came to a bleak spot, covered with coarse *heather*, where numerous boulders lay on every side. Here we rested for a few minutes and enjoyed a cup of cold tea. During the next half hour we had to crawl under and above fallen trees, and finally arrived at Paka Paka cave at 12.15 P.M. Height 10,262 feet. Thermometer 58°.

At 1 P.M. the sun broke out, but no view could be got, owing to the thick mist. Soon the rain began to fall, and in a few minutes the Kadamayan, which had been a shallow stream running past the entrance to our cave, became a roaring torrent, bounding over the large boulders in its bed. Equally soon, the stream subsided when the rain stopped.

Paka Paka cave is a shallow hole scooped out of a hornblende cliff by the adjacent stream. Its floor is earthy and covered with charred wood from deer-hunters' fires. The entrance was partially blocked up with my tent, and three fires were lighted. My mat occupied the back part of the cave, as I could not again endure the smoke torture of the former night. The Dyaks and Kian men slept on a ledge of the cave, warmed by the smoke, and the rest disposed themselves around the fire. I put on an extra suit of drill clothes, singlet and stockings, and over all my waterproof coat, lending my blanket to Pangeran Sahbudin, who had fever; but in spite of my precautions I did not sleep a wink. There was an entrance for the cold wind in spite of our precautions, and the thermometer registered 52° at 5.30 A.M. inside the cave.

I asked for volunteers in the morning, obtaining eleven who wished to accompany me up to the summit. The names were written on a page of a note-book and put into an empty brandy bottle. The cork was secured by thread and candle-grease. The names were: Pangeran Sahbudin, Goot chief in charge, P. C. Nanggai and Nchangan, and a Dusun relation, Jemain, Somah, Pangolin, Mapadri, coolies, Gawang, two guides (Limbawan and Tambias), and myself,—twelve in all.

We started at 7 A.M. After twenty minutes' climb we passed out of

the thick jungle, having had constantly to clear the obliterated path with low branches on every side, and came to the granite face of Kinabalu. I managed to walk up with my shoes, but found it dangerous, so took them off. The easiest slope lay up the tiny rivulet representing the Kadamayan or Tampasuk source. We stopped at 10,712 feet, and had a view of the waves of mountains below, bounded by the Labuk Sea on one side and Papar on the other. My compass bearings were—E. coast sea, S.E. by E.; Gaya, W.S.W.; Sindātun Hill, S.S.E., which would prove that I was ascending the south side of the mountain. The granite face is very regular, except in the vicinity of the peaks, and is only occasionally varied by small clumps of twisted, stunted trees, somewhat like firs in the matter of foliage.

We first had to scramble towards the eastern side, then towards the west, finally straight up to the summit, arriving at 10.10 A.M. in a very cold and hungry condition. Owing to the thick mist, we had some difficulty in overtaking our guides and Gawang. On rejoining them, I was rather disappointed to hear that they had been up the peak which St. John ascended in 1858, and which ranks as No. 2 in height. I inquired if they had seen Low's bottle, but Gawang answered, "Eutah," meaning "Who knows?"

We were sitting in the gap between Victoria Peak, the highest and most easterly, and the adjacent peak, which the Kian men had just climbed. A piercing wind was blowing in furious gusts through the gap, and our hands were numbed with the cold. I took my pocket aneroid out, and was surprised to see it only gave 11,312 feet above sea-level as the height of the summit, the thermometer registering 54°. The sun was shining brightly, but it failed to dispel the mists below. Victoria Peak I calculated to be 250 feet high, and the next peak to the west (St. John's Peak) about 100 feet in height, so the aneroid height, plus 250, should give the total height of our "show mountain" as 11,562 feet, or over 2000 feet lower than the usually accepted height of 13,698 feet.

I advanced to the edge of the abyss and looked down, and saw a gulf of unfathomable depth, the bottom of which was lost in mist. Then a policeman ran forward and pulled me back, saying I was sitting on a wall of loose stones, which created a feeble laugh, for it would require a lever to lift the square blocks of this ancient parapet. Pangeran Sahbudin informed me he saw the last or fourth side of this gulf, which I required in order to work out the volcanic theory. A momentary clearing of the mist had revealed the further rim of this crater far below us. There must have been two great eruptions in former ages. The first burst through the rim of the crater on one side (the southern), and left fragments now represented by the peaks; the second broke away the northern or further rim, and reduced its height. Could not the smooth face of the gigantic granite slabs, all at the same angle, be explained by reason of friction from a mighty flow of lava?

It is incorrect to say that Borneo, or even British North Borneo, has

not been volcanic, for Mr. Resident Davies has obtained lava specimens, and I found some in a stream on Maliwali Island in 1886 which I submitted to Mr. A. H. Everett, who was on a visit up coast at the time.

I was disappointed that Victoria Peak was inaccessible, and when I asked for volunteers to come up with me to the top of St. John's Peak, I received no response, and did not press the matter, determining to get to the top of Victoria Peak some other day. We hurriedly sacrificed the fowl and started down, when Gawang said he would go up St. John's Peak and lay my bottle and the brass-ware on its summit; this he accomplished and soon overtook us.

When 200 feet down, the mist around Victoria Peak cleared away, and we noticed that its side facing the east was at a moderate angle, and quite capable of being ascended. But the gruesome mist was again creeping around us, and our empty stomachs warned us not to delay on the road; so we left the feat till next year, but not without regret. By this time my stockings were worn out, but the granite was just rough enough to prevent sudden slips without wounding the feet; occasionally, in the crevices, one came on a few jagged fragments, and a contortion of the features showed an unwary step; but on the whole I preferred descending to our late toil of going up. Down the steeper inclined slabs, the Dyaks assisted me, holding my hands, and only once, near the jungle, did I fall on my back, nearly dashing out my brains against the rock.

When we passed along the slimy water-covered granite, where one of Sir H. Low's coolies slipped and nearly rolled down a precipice, we only had a sharp-edged crevice to walk on, but a look downwards made us forget the pain. I picked several specimens of mountain lilies, the B. N. B. fir, and some of the "ghostly buffalo" grass on the way, and had a long drink from the ice-cold spring which flows out as the Tampasuk or Kadamayan river. I have omitted to mention that the lofty peak seen by St. John S. $\frac{1}{2}$ E. from the summit is probably Trus Madai Hill in the interior of Padas, bearing from our point of view S.-W. by S.

On arriving at the jungle, the rainy mists were dispelled by a brilliant burst of sunshine. The thermometer registered 69° in a spot sheltered from the wind. We arrived at the cave at 12.30 P.M., and were glad to see our less active followers had at any rate prepared a meal, which we attacked with the appetite of men who have been starving for twenty-six hours; meanwhile, our loose baggage was being packed, and when ready, I despatched half the men with it, with orders to await us at Tamborongah. I informed my men that I should give 2 cents for every perfect pitcher plant, and other prices for other plants, if brought safely to Kian.

We started at 4.45 P.M., and although we pushed on, my strained knee prevented much progress. Before reaching our camp I had to light candles, but we got along without accidents. To-day we have gone through 8 $\frac{1}{2}$ hours' hard walking and climbing, and I was not surprised to find myself seized with severe cramps in both legs after supper. Datoh

Benawa, Bunahow, and Tamputan from Kian gave me all the local news on arrival. They had brought up rice and tobacco as arranged.

We started late the next day, not leaving before 9 A.M., and took the path Gawang had used, which follows the left bank of the Kadamayan. The hill was very steep, and slippery from the tracks of the preceding coolies. My knee got worse and my progress slower every minute, so I sent on most of the men, and followed at my leisure. I found my men waiting at Labong stream, under an overhanging cliff of conglomerate and crystals. They had arrived there in three hours from Tamborongah. The thermometer registered 64°. I feel completely crippled and sore all over.

The thermometer fell to 61° at 6 A.M. We started at 9 A.M., following down the Labong for some distance. Leaving the stream where the waterfalls commence, we struck up the left bank, going S.-W. by W. towards the Kadamayan. We crossed a tiny stream, S. Solawkon, at 11.25 A.M.; arrived at noon at the Kadamayan; and after our meal started down the river at a quick pace, fearing floods, as the river was rising. We stopped again at Mitimbok gorge, and finally arrived in Kian at 6 P.M., putting up at Bunahow's house.

Here Limbawan, my guide, informed me through Gawang, that he had brought down the papers of Messrs. Low and St. John; the former in a bottle, and the latter in a tin. I felt vexed at his having deceived me, but said nothing; and exchanged another bottle for the one in question. From the tin, a small coco or chocolate and milk one, I withdrew a piece of the *Oerland Mail*, dated January 9th, 1858, which contained a page torn from a pocket diary, on which was written in pencil:—

the
here with the bottle. peak

Spenser St. John.

April 30th, 1858.

In the bottle, probably an old Bass's beer bottle, I found fragments of *The Agricultural Gazette* and *The Gardener's Chronicle*, but the dated side is missing; also a pencil name with the words—"Govern (ment) (La) buan ds. 5 Bar (ometer) ninth" still distinguishable. Mr. Low (now Sir H. Low) made the ascent of Kinabalu in 1851; so, I suppose, both bottle and papers must be over thirty-six years old, and have successfully withstood gales, rains, and mist during that time.

The Kian natives now killed the cow, for which a goat had been substituted before, during the ceremony consequent on taking the oath of friendship. Bayer, the father of Bunahow, we found to be a talkative old man; in fact, I dropped off to sleep, and when I awoke he was still declaiming.

The wild raspberry grows in abundance on the village green, but the natives do not utilise it. During our walk yesterday the Dyaks found the "libu" creeper, as they call it, which, they sentimentally said, reminded them of the fragrant breath of the Dyak women. This, I believe,

is the same creeper whose leaves steeped in warm water are used as a substitute for tea by the Orang Sungei (Sulu refugees) of Labuk and Tongad. At Nyot Tonggal in 1883, a village on the latter river, I drank many cups of this "tea," and did not dislike the taste.

Bunahow's brother, who has a shrunk leg, is sitting next to me, and employing himself shredding tobacco leaves. The leaves are of medium size, and unbroken. In cutting, the performer uses a long bamboo knife, and, to prevent accidents, has a bamboo joint on his left thumb, which keeps the leaves steady on a three-legged stool, representing the block. The tobacco is afterwards made into rolls, which are folded into a parcel $14" \times 3" \times 2"$ deep. These, I subsequently heard, were sold four to the fathom of black cloth, or $4\frac{1}{2}$ cents each.

Tambias, our late guide, informs me that he stood and watched cave-swallows flying in clouds out of Bakih Simparnan, one day's journey from Kian. Tambias I found to be an intelligent young man, and I believe his report, but as the Kian men appear to be coming to the end of their rice, and provisions are five times dearer than in Tuaran, I postpone prospecting for the cave.

In the evening Si Guras, a sister of Bunahow's, entertained us to "juggans." When the Hill-Dusuns sing they prefer to lie on their backs, saying they are more comfortable in this position.

All the houses here have sloping bamboos up to the front verandah instead of steps, or a notched log; and, in consequence, the men near the door are disturbed by porkers during the night.

Starting at 7.35 A.M. on the 20th March, we returned to Labong Labong at 10.20 A.M., and had our noon-day meal at Tampulan's house. I bought some honey in the comb, a rather common delicacy amongst the Hill-Dusuns, for each house has a bee's-nest attached to the side of the window, close to the sleeping-dais. I left for Kahong, and crossed the Kadamayan twice. At Kahong ford the water was waist-deep, and every moment rising. We put up at Lampayan's house, the coolies as usual finding out their own quarters. The next morning Tampulan arrived, and stated that he was coming with me. Directly afterwards I went to bathe, and noticed Tampulan being belaboured by a woman. I thought he had been "larking," but the enraged female turned out to be his wife, who insisted on his following her back; and he had to go.

Starting down the Kadamayan or Tampasuk (the river St. John calls Kalopis) at 11 A.M., we took the path following the river, and crossed several small streams, the Kadamayan thrice. At the last ford, opposite Dilongan Tipud Hill, the river was breast deep, and forty yards wide, and being in flood, we thought some one would come to grief, so tried to stretch a rattan across, but the first man who attempted the passage broke the rattan, and just escaped being dashed among the rapids below. The Hill-Dusuns then crossed by lightly hopping with the current from one foot to the other. We all followed suit, and I can state that I shall never trouble myself about deep rivers in flood again, for,

providing the water is not above one's head, or the rocks too close, nothing can be easier than to cross in this manner.

Rain commenced as we were crossing, and continued up to 3 P.M., when we arrived at Tambatuan village, after trudging up a long and greasy hill. The clay-hills of Tuaran are terribly annoying after a shower of rain. I remember constantly making four or five unsuccessful attempts to walk up certain smooth places in the path.

The headman Lintaid's house was leaky, so we put up at Limbun's house of three doors. To arrive here, St. John must have used another path, for he only crossed the Kadamayan twice near Dilongau Tipud Hill, after making a detour to the east. Lintaid excused himself from coming, as he was roasting two monkeys he had snared. Next morning, the 22d March, I wrote to Mr. Whitehead, who was still at Melangkap, lower down. I started for the coast at 11.30 A.M. At the last moment Lintaid rushed up, saying he had been again roasting monkeys, and wished to speak to me, but I refused, and left the wretch to revel in more monkeys if he liked. Gawang had persuaded me to visit this village, saying Lintaid wished to come down with me, but he seems to have changed his mind. At 6 A.M.—thermometer 70°, aneroid 1752 feet.

We crossed the Tampasuk river, or Kadamayan, beyond the gravelly stretch below Tambatuan, and toiled up a long steep hill, making a path through tall grass, and, on arriving at the top, were of course bathed in perspiration. A coolie from Tamperuli, in Tuaran, became prostrated with fever, and it was with great difficulty I induced any one to carry him even with the promise of a dollar. Shortly afterwards the carriers struck work, but had to come to their senses, for, when remonstrated with, the grumblers and I shouldered the sick man. As a proof of his lightness a strapping Dusun hoisted him up on his back, and walked quietly down hill with his load. The rain commenced as usual in torrents, and we hurried on, finding shelter in a small padi hut of larger dimensions than usual. The Dyaks walked on, saying they would get quarters ready at the nearest village, whose cocoanut trees were visible afar off, and dimly through the mist as "through a glass darkly." We lighted fires in the meantime, and stripped our patient, making him wear my water-proof coat, that being the only dry article in our possession. After a while he became better. Shortly after the rain had stopped, P. C. Nchangan appeared, and led us down through padi fields and along the Lemawng stream to Lemawng village. We arrived there at 4.30 P.M., putting up at Musah's house, and congratulated ourselves at being again among the Coast-Dusuns.

Lemawng village possesses two houses, and pays \$10 poll-tax per annum through Si Ahmat of Madang. Lemawng stream is a tributary of the Si Damit, which flows into the Tuaran river near Along. I gave Musah a tin box, which had contained cigarettes, and he presented me in return with some honey and sweet potatoes.

We started next morning at 6.40 A.M. The sick coolie proceeded

with us part of the way, but was soon left behind to follow on at leisure with his brother-in-law. After crossing the Lemawng seven times we ascended a hill, arriving at Ginambor Bundoh village at 8 A.M., and then crossed the Si Damit nine times, arriving at Rungus Manuntun village at 11.45 A.M. From here to Madang we had simply to wallow along a buffalo path, occasionally varied by clay hills, arriving at Madang at 12.45 P.M. At 4 P.M. Pangeran Sahbudin and I borrowed Ahmat's "gobang" (dug-out), and paddled down to Tapakawn. The others walked *vid* Tegās Hill to reach the same village, only eight, however, arriving that night.

Next morning the river was in high flood, but the rain had stopped, and, waiting till all our men had arrived, we started at 8 A.M. Several times crossing tributaries, we were obliged to swim and wade breast-deep; but nothing seemed to delay us, and in four hours we had traversed the distance between Tampakawn and Tand, the Government station.

APPENDIX.

There is little doubt but that the Tampasuk route to Kinabalu is the longest, and by no means the easiest.

The following plans of march may be of assistance to others wishing to explore the mountain, and I have proved that coolies are easily obtainable in Tuaran, but *not* in Tampasuk even for high wages :—

Labuan to Gaya Island, by s.s. "Paknam," eight hours, or by s.c. "Bujang Baram," under special favour of Mr. A. H. Everett, the Consul for Sarawak, or by boat, two days' sail.

Gaya Island to Borongis, Tuaran *vid* Mengkabong, by boat six hours, and across plain to Buntai, two hours' walk.

Buntai village to Sinilau village, 3¼ hours' walk; hills.

Sinilau village to Bungol village, 8¼ hours' walk; hills.

Bungol village to Labong Labong village, 3¾ hours' walk; hills.

Labong Labong village to Kian village, 2¾ hours' walk; hills.

Or,

Gaya Island by boat, to Government station, Tuaran, six hours.

Station to Madang village, eight hours, flat walking.

Madang village to Lemawng village, 6 hours, flat walking, and hill walking.

Lemawng village to Tambatuan village, five hours; hill (on the Tampasuk river).

Tambatuan village to Labong Labong village, five hours; flat (on the Tampasuk river).

Labong Labong village to Kian, 2¾ hours; hill (on the Tampasuk river).

The first route is the quickest by a day, and requires no crossing of rivers between the Tuaran and Tampasuk, whereas in the latter several have to be forded.

THE RELATIONS BETWEEN COMMERCE AND GEOGRAPHY.

BY HUGH ROBERT MILL, D.Sc., F.R.S.E.

*(Introductory Lecture to the Class of Industrial and Commercial Geography
in the Heriot-Watt College.)*

THE latter part of the nineteenth century differs from all preceding epochs, by the high differentiation of its activities, exhibited as division of labour in industry and as specialism in science. The two spheres, although polar in their objects, are yet most intimately related at every point. Every department of industry is reforming its methods, endeavouring to work with less waste and to more purpose. To effect this there must be an intelligent comprehension of the end in view, perfect knowledge of the material worked upon, and power over the means employed. It is the part of science to ascertain all the essential facts, not primarily for the benefit of the industrialist, but for the advancement of human knowledge; and it is the duty of science to place freely at the disposal of those who are ready to apply it all the information that has been accumulated. Hence it comes that each of the more important departments of industry, in producing, manufacturing, and transporting material, is intimately associated with some special branch of science, the two mutually supporting and extending each other. The various branches of science and of industry interlace in continually subdividing ramifications.

The British public is now awake to the importance of this fact—most other nations awakened to it a generation ago—and technical instruction is being forwarded with the zeal of one who has been a sluggard and who rides apace. The importance of a workman being acquainted with the scientific basis of his handicraft cannot be overestimated, he not only does his work better, but he may—even in this age of highly developed processes—help to improve the applications of science, to discover new facts which advance the powers of research, and in no long time prove fruitful in fresh applications. Everywhere the rule of thumb is giving way; the balance, the burette, and the thermometer regulate manufacturing processes; but this has not happened until the necessity for it appeared. Priestley's experiments on fixed air were stopped a century ago, because the brewer who had allowed him to make observations on his vats thought that the experiments spoiled the beer. Pasteur's more complete following up of similar researches revolutionised brewing and made it a branch of science. The specialists in industry, as in science, press ever deeper into their ever-narrowing grooves, until to ordinary men they sink from sight like the cañon rivers of a high table-land. The philosopher surveys from an eminence the network of ravines in which scientific specialists are at work. He traces

their movements, generalises, combines, and organises the whole, yet he does not profess—or he does but profess—to be profoundly learned in each department. That pertains to the specialist; the generalising philosopher is content with an accurate and wide knowledge of the essential elementary principles, and the outstanding facts. In much the same way the merchant overlooks the labyrinth of industry, and, without complete knowledge of all the processes, he generalises and directs them. He may not know the precise change in the spectrum that warns the steelmaker to turn off the air-blast, and empty the converter; but he must have a general knowledge of the process of steel-making if he deals in metals. He may not know how the master of his ship fixes position at sea, nor how the Mercator differs from the great circle course on each ocean-route, but he should certainly know enough about navigation to estimate the probable length of a voyage. He may not know much about anthropology or philology, but he must know something of the manners, the customs, and the languages of the people with whom he trades. Such examples might be multiplied to infinity. No one will question that commerce is as important as industry, collection and distribution as necessary as production; but while the energies of the most powerful minds have been devoted to the improvement of processes, and the technical education of workmen, little has been attempted to systematise the principles of commerce, or instruct merchants and their clerks in that wider but accurate general knowledge which is of primary importance to them. It is perhaps supposed that the education of “any schoolboy” enables him to become a man of business by simply acting under the guidance of those already engaged in commercial work. But it is becoming plainer every day that not only is a knowledge of modern languages, of arithmetic, and of nominal geography necessary, but some acquaintance with political economy, history, and physiography as well.

It is the part of Industrial and Commercial Geography to supply in one department—and that perhaps not the most important—the want that is so patent; and at the outset it is well to explain how much is included under this name. It is not easy to define in few words a subject that is so far-reaching and so general, and the formulation of which has as yet scarcely been attempted.

Geography is the science which treats widely of the earth as the home of man, taking account of all the varieties of configuration of the land and water surface, of the natural and political divisions, and all the conditions resulting from these. Commercial and Industrial Geography only includes so much of the general scheme as has a direct bearing on the distribution of the products of value to mankind, and the means of rendering them available. Commerce is a channel, fed by the widespread springs draining areas of production, flowing into the great trade centres, and re-issuing in numberless streams to the regions of consumption. In its primitive form it is simply the process of exchanging surplus commodities for others of a different kind, and forms

a natural and necessary accompaniment to division of labour. The real cause determining all the complicated modern developments of the commercial world is that commodities are so abundant, or that they can be made so abundant, in some places as to be unnecessary, or at least superfluous, while in other places they are necessary or of value. Hence, at the outset, two great and distinct branches of science are required to throw light upon the relations of commerce, Physiography to show why products occur naturally in one place and not in another, and Economics to define value and equivalence of exchange. The two are of equal importance. The Society of Arts' Syllabus of Commercial Education gives this definition :—

“Commercial Geography treats especially of the principal places in which trade originates, and of the varieties of produce characteristic of each ; of distances, routes, and ordinary modes of transit or conveyance to important markets ; of different currencies, weights, and measures, with English equivalents. In its widest range it comprises such portions of natural history and of the applied sciences as are necessary for the correct classification and commercial appreciation of raw produce of every kind.” Dr. Yeats, practically the only English writer on the subject, says : “Commercial Geography differs from political in giving precedence to the distribution and the utilisation of raw materials or of goods. It aims at showing a merchant where and when what he wants can best be had, whether corn or cotton, timber or wool ; and also where that which he offers is most likely to be introduced to advantage. It helps the ship-owner to see what produce is accumulating, and where freights may fairly be expected.”¹

Mr. Kenric Murray, in his recently published book,² restricts the scope of Commercial Geography to “the study of the economic distribution of commercial products in undeveloped countries.”

The position of manufacturing centres with reference to areas of production is a fact of the first importance, and the conditions leading to the proximity of these or to their separation are deserving of consideration. The relation of commerce to geography has been most intimate in the history of exploration, and by studying this we may both obtain a clear understanding of the principles of commerce, and realise the gradual process through which the fabulous and the monstrous were dispossessed from the geographical mind, and clear, accurate conceptions substituted. There are two great modifying influences which affect Commercial Geography unequally—the physical and the political conditions of various countries. The physical is always the greater power, although occasionally for a short time the political element has had the predominating influence. These are hardly sufficiently brought out in the definitions we have cited above.

¹ *Recent and Existing Commerce* : London, 1887, p. vii.

² *Commercial Geography*, London (not dated), published 1887, p. 1.

There are numberless ways of drawing near and breaking in upon every special department of knowledge, much more upon any general field such as this. The first to suggest itself is the natural or historical method, tracing growth and development; another is the actual, statistical or geographical, taking up each region in detail, and studying its exports and imports; a third is to consider the raw products of commerce individually, and trace their distribution in various countries, their production, manufacture, and the special commerce to which each gives rise; and there is the complete method of ascertaining the underlying principles of production, transport and consumption, with the conditions modifying these, then deducing conclusions in a theoretical manner, and modifying them by comparison and actual observation. It may not be possible, in a short course of lectures, to follow any one of these methods in its entirety; or to pay equal attention to all the subjects which should be treated. It may help to give an idea of the general relations of Geography and Commerce if we at first consider them historically.

Two motives which lead to exploration of unknown regions have from all antiquity been the same—the desire for gain and the love of power. The former drew caravans of merchants, with their wares for exchange, across pathless deserts; tempted them down unknown rivers; even led them out, creeping from point to point, along the shores of the vague and terrible sea. This led also to the raids by land and sea of those who had no commodity save personal courage to offer in return for the coveted goods, who consequently adopted the old and simple plan of taking whatever could not be kept from them. The separation between legitimate commerce and plunder was slender in early ages; now it is supposed to be very substantial. The lust for power led armies into regions and through dangers that no other influence was strong enough to make men dare. Even in our own day, the war-ships of the great nations may be seen hovering round the few unappropriated islands of the sea, jealously watching each other for the first chance of swooping down upon the prey. No wonder, then, that there was some hard fighting, when continents stretched in unknown vastness before Alexander, and when new worlds in the west and east opened up to the view of the monarchs and adventurers of Spain and Portugal. Two other agencies there are, of more recent date and nobler purpose, to which much, if not most, of our modern completeness of view over and through the oceans and continents may be traced—missionary zeal in spreading religious truth, and scientific intrepidity in daring all dangers for the sole sake of knowledge.

It is with one division of the first and most far-reaching influence that we are to deal at present. Commerce has never flagged, never scrupled to take advantage of the other methods, and the history of commercial exploration is one of sustained interest from the dawn of civilisation till now.

In early times many things retarded geographical knowledge. There

was no means of determining position except by a rough measurement of distance traversed, there were no regular records kept of the journeyings of the caravans and galleys; and neither the disputations of the Middle Ages nor the more sober methods of modern research can now determine the sites of Ophir and Tarshish, whence King Solomon's navies brought him "great store of almug trees and precious stones," "gold and silver, ivory, and apes and peacocks." There is reason to believe that at an early age the Phœnicians traded to India, partly by caravan on land, partly by a route which, if they really used it, reflects much credit on their power of appreciating and utilising natural advantages. It is said, they made up caravans at Tyre or Sidon, travelled eastward to the Euphrates, sailed down that river to the Persian Gulf, and along the coast to India; then, taking advantage of the north-east monsoon, they crossed the Indian Ocean to the shores of Upper Egypt, where a short land journey enabled them once more to take ship on the Nile, descending which, they were enabled to return by sea to their port of departure. Phœnicia was long the great maritime nation of the East; its commerce, meeting with the competition of the new and stronger Hellenic civilisation, was gradually compelled to go further afield, beyond the pillars of Hercules. Spain was not the goal of the Phœnicians; they pushed northwards, crossing the Bay of Biscay, and, mining tin in Britain—possibly even digging amber on the shores of the Baltic—brought back these products of the North to mix in the markets of Tyre with the gems and precious metals of India. The supremacy of Phœnicia gave place to that of its colony Carthage, which held its own against the Greek trade of Corinth until the Romans subjugated both. Throughout the Roman period, and after the decline of the empire, the Mediterranean remained the seat of trade, and Venice and Genoa rose in power. In the Middle Ages a rival route from India passed through Khiva and Novgorod to the Baltic, whence the Northmen—more celebrated for their more congenial expeditions of piracy and plunder—distributed it through northern Europe. The discovery of America by the Northmen in the ninth century was an incident without any influence on trade or on politics, and soon forgotten; but a momentous time was at hand. Europe was awakening from its mediæval sleep. A number of northern towns, banding themselves together in the Hanseatic league, advanced commerce by pursuing it systematically, protecting themselves by fighting when necessary—and in that age of insecurity that was often the case. The leading naval powers were still on the Mediterranean; but Holland, with the Zuyder Zee now opened to the ocean, was preparing to take its place in the maritime world.

In the first quarter of the fifteenth century, the Mediterranean was in very truth the centre of the known earth: to the west lay the awful Atlantic, barred even along the African coast by superstitious fears; to the north, the west coast of Europe and the Baltic were thoroughly

known, and Iceland was occasionally visited by the Venetians. To the east were the luxuries and riches of India, but the path to them led past the pirate-haunted coasts of North Africa, and overland through Egypt to the Red Sea. The difficulties in the way were so great that few men visited India from the west. Cathay was a traditional region in the extreme east, of which little was known. India was the dream of the merchant, and to reach India by a direct sea voyage was the great commercial problem of the day. Prince Henry of Portugal, a man whose name we should delight to honour, spent his life in furthering the exploration of the West Coast of Africa, and, in spite of much opposition, laid on the waters the foundations of that fairy palace of wealth and power which made the Iberian nations the envy and wonder of the world for a hundred years. In 1486, twenty-six years after the Prince's death, Diaz reached the Cape of Good Hope, but feared to go further. Ten years later Portugal was enriched by Vasco da Gama's first voyage to India round the Cape, and from that time geographical discovery in the East went on hand in hand with trading and plundering. The state of the Mediterranean, always dangerous, became so unsafe in consequence of the successes of the Turks in Europe, that trade practically deserted it, and Venice lost her ancient power.

In the interval between the exploration of Diaz and Vasco, Columbus in 1492, and perhaps Martin Beheim before him, had crossed the wide Atlantic. Columbus was certain, from his own observations at the Azores, and from a study of such maps as were in existence, that India could be reached by sailing west. The world was then supposed to be much smaller than it is, and the exaggerated breadth given at that time to India and Cathay made the sea voyage appear comparatively short. Even at the time of his death Columbus believed that a way would be found through the Caribbean Sea to India; such a way is now being made.

The American continents were rapidly delineated by successive expeditions nominally fitted out for trade and exploration, really for plunder. Precious metals and new products of all kinds poured into Europe; the valuable plants of Asia were carried to the New World, and thrived with unexampled luxuriance. The Pacific was discovered, the world circumnavigated, and for all this magnificent unveiling the greed of gain in the twin powers of commercial and piratical enterprise is to be thanked. The Mediterranean was no longer the centre of the world. The Atlantic became the highway of the nations. To suit its new conditions navigation rapidly improved, larger vessels were built, the sextant was invented, charts were constructed, seaports were deepened, and the western coast of Europe soon became the focus of the world's activity, the outlet and inlet of all important commercial products.

The opening of the sea route to India was only second in importance to the discovery of America, and not until the great powers, early in the present century, crushed out Algerine piracy, and later, when the energy

of Lesseps pierced the isthmus of Suez, did the eastern trade partly return to its old channels. Australia was discovered and colonised, and the colonies in South Africa alone ensure that the routes to the east by the long passage will never be discontinued. Maritime discovery is now practically at an end except in the Polar seas, where commercial motives are not at present strong enough to tempt adventurers. There was a time when Polar exploration was looked upon as the key to India, and for nearly 300 years ship after ship, manned by sailors whose daring has never been surpassed, and whose endurance has only been exceeded by scientific explorers, pushed northwards, sailing into every channel of the ice, working always westwards in the hope of discovering a north-west passage to the Pacific. Although such a sea road has been known for more than seventy years, no commercial use can be made of it, on account of the dangers and uncertainties of navigation in the ice. The inutility of another favourite scheme—the discovery of a north-east passage—was fully realised by the Dutch Government, when Nordenskiöld, in 1882, demanded and was refused the premium of £2000, offered by the Netherlands in 1596 to whoever should find a north-east route to India. Still the accessibility to commerce of the North Siberian ports during even a small part of the year is a matter of some importance, and places the north-east passage on a different footing from its less practical north-west rival. The decline in the value of whale-fishing has taken much from the geographical work formerly done by whalers in the north; and as yet no sufficient inducement has been found for merchants to explore the frozen south.

The immense value to science of a knowledge of the Antarctic regions, and the difficulty of moving those who are able to undertake research in such difficult conditions has led the scientific societies of Australia to enlist the aid of commerce. Rewards have been offered on certain conditions to vessels which bring home a cargo of any commodity from a position south of 60°. Analogy with the northern trade, and the known conditions of the south, would suggest that some new areas of production might ultimately be opened. It may appear chimerical to go to the Antarctic seas for ivory; but there is no reason why the frozen mammoths of a long past age may not be waiting sealed up in ice for the adventurous mariner to disentomb: there is a strong probability of a profitable whale and seal fishing being established.

Within the last thirty years one of the most interesting contributions of commerce to scientific Geography has been the knowledge it has given us of the state of the bed of the ocean. We pass over, as too obvious to require comment, the enormous development of navigation since steam-power was applied to merchant ships; now it is with the other marvel of the century that we have to deal—the submarine telegraph cable. At first when cables were laid only in shallow water, or between great continents, difficulties arising from the form of the sea-bottom were hardly felt. A line of soundings at long intervals across the Atlantic sufficed for

all practical purposes; but when the results of this experience were applied along the west coast of Africa, and towards the approaches to oceanic islands such as Bermuda, snapped cables repeatedly taught the necessity of more numerous soundings. The problem of bringing the precious wires from their horizontal position at the depth of two miles or so, up the side of submarine mountains, rugged and even precipitous in places, had to be met and solved. The close surveying necessitated in this way showed that some parts of the ocean abounded in submarine mountains rising up from vast depths with an abruptness that was never before suspected.

At present the effort of commerce is less to discover new fields of production of raw materials than to open up new markets for manufactures, and most attention is consequently being directed to the interior of the great and thickly peopled continents of the old world. India and Cathay were the merchant's dream of the past, and they are in great measure his hope for the future. The wide and continuous coast-line under British rule, from the Indus to Singapore, gives this country enormous advantages as regards marine traffic in the east. But even with an improved system of inland navigation and increased freedom for trading in China, the greater part of that country must remain inaccessible from the sea. After being eclipsed for ages, the overland routes through Asia must regain importance if full advantage is to be taken of the capacity for commerce in the vast areas of dense population in China. Such is the opinion of those best qualified to judge on this matter, and it is obvious to all that, if this be the case, the rivalry on the sea, in which Britain has long held unquestioned pre-eminence, must give place to a rivalry on land, in which the ultimate success of other powers may very easily be secured. The railway-route surveyed by Hallett, through Siam from Moulmein¹ to the borders of Chinese territory in Yunnan, would certainly secure advantages to British commerce such as no other pathway could offer, and the efforts of Mr. Colquhoun, now lecturing on the subject in this country, ought to place the proposed enterprise in a favourable light before practical men. The railways of Russia are slowly creeping further east. They stretch across the vast sandy deserts of the Transcaspian district to Samarcand in the south, and we cannot expect that the great northern plain of Asia will long be neglected in this respect.

Inland carriage cannot as yet be accomplished on a scale comparable to that effected by shipping. Canals are slow at the best—in winter they freeze in the north, in summer they dry up in the south; rivers have similar drawbacks, and railways require engineering works on such an extensive scale as to be undertaken only where traffic is assured. If the late Professor Fleeming Jenkin's scheme of Telpherage were to become a commercial success, pioneer lines could be laid out as easily as an overland telegraph, and electric carriage on land would soon vie with steam

¹ *Scot. Geog. Mag.* vol. ii. p. 78 et seq.

transport at sea. The geographical exploration of great continents is a slow process, and much yet remains to be known regarding the interior of all the large land masses of the globe. In the New World this exploration is made comparatively easy, for the conditions of rapidly extending population make it possible first to lay out a railway line, and then to form cities along the route to maintain it by their traffic. The Pacific railways of the United States and of Canada are enterprises which have done a great deal to place our geographical knowledge of America on a definite basis. Commercial exploration in Africa is continually driving inland new lines of traffic to tap the stores of the interior, and to open channels through which European manufactures may be poured into the heart of the continent. Germany is the great power in this region, and British trade, unless it too is supplemented by far-seeing and experienced explorers—commercial travellers in the highest sense—will soon be comparatively inconsiderable except in the colonies, and at a few points on the coast.

We see how in the past, expanding commerce has beaten upon the confines of the world, until these, opening out, revealed new regions across the waves. We see how exploration and calculation gave true knowledge of the form and size of the globe, and showed the shortest route from one point on the surface to another; how conditions of climate made some of these a permanent impossibility; how political transitions interposed temporary barriers across others; and how the redistribution of the centres of trade followed naturally on the re-arrangement of the channels of commerce. Finally we see that the problem of sea-carriage—to the ancient world insuperable—has been fully solved, and that the rate of progress in the immediate future must depend on improvements in inland transport by rivers, canals, and railways; all being of course worked in connection with the existing ocean routes, or with those that may result when all the isthmuses that can be severed are cut by canals. Trade has now many centres, and its influence connects all parts of the world in a network so close that it is unlikely that the future will see any such great changes as the past has witnessed. One centre may rise or fall in comparison with another, but commerce will hardly be forcibly diverted in permanency from its present channels. The same principles lead us to see how special industries are localised in particular places. Towns arise in strict obedience to easily traced laws, and when it happens that manufactures are carried on at a distance alike from the source of the raw material, and the destination of the products, these principles furnish a sufficient reason, or show that the reason no longer exists, and that the practice should be changed.

To illustrate another method of approaching the subject of Industrial and Commercial Geography, and to indicate how numerous are the conditions which have to be taken into account, I may take up one trade material, and follow the main points in its history to the present day. Classical authors in the time of Alexander the Great refer to sugar as a

kind of vegetable honey found in reeds growing in Asia: "sweet cane" is mentioned by Jeremiah and Isaiah as coming from a far country; but there is no proof that this sweet cane was sugar. In the time of the Crusades, the capture of camels loaded with manufactured sugar occasionally gladdened the camps of the Christians, and at that time Arab physicians had long used it as a medicine. The original habitat of the sugar-cane seems to be the region between Bengal and Cochin-China. The cane was introduced by the Arabs into all the Mediterranean countries on which they secured a footing; and thus Morocco, Sicily, and Spain were planted early in the Middle Ages. The limit of cultivation was about 40° N. lat.; further north the climate was too severe, and the plant did not live. Venice became the great emporium for sugar in the Middle Ages, and in 1319 it is recorded that 100,000 lbs. were shipped thence to London. The Spaniards planted the cane in Madeira in 1420, and as soon as the West Indies were discovered they carried it there, San Domingo receiving the first instalment in 1494. The soil and climate were so favourable to the growth of the Asiatic grass that early in the sixteenth century most of the islands and a great portion of tropical America waved with its feathery plumes, and sugar-making on a scale of rough extravagance became the staple industry. During the eighteenth century sugar, from being an occasional luxury, became a necessity in civilised life. The fashion of tea-drinking, which formed such a feature of the age, consumed the greatest quantity; and the rate of increase in its use may be gauged from the fact that in 1700 the imports into Great Britain were 10,000 tons, and in 1800 as much as 150,000. In 1885 the imports had risen to the enormous amount of 1,100,000 tons, and their value in 1886 was £16,000,000, a falling-off from three years before, when it was £25,000,000. These statistics appear to show a progressive development, but the vicissitudes of the sugar-trade were, and are, very remarkable. In the first place, slave labour was required to cultivate the West Indian plantations; the national conscience in Britain became roused to the enormity of this infringement of the rights of man, and, when at length in 1833 slavery was abolished, the condition of the West Indian estates became very critical. The old wasteful processes produced raw sugar of the coarsest description, which was shipped to Europe, and refined before coming into the market for consumption. The soil, originally so fertile, gradually became exhausted, and to add to the thronging difficulties, a new and formidable rival appeared in Europe. In the revival of chemistry, which preceded the French Revolution, every natural product was analysed, and sugar was found in the juice of many plants. In 1747 Marggraf detected it in great abundance in the beet and other fleshy roots, and in 1801 a factory for manufacturing beet-sugar was opened near Breslau. The sugar (saccharose) is chemically identical with that of the cane, a variety differing entirely from grape-sugar or glucose, into which it can be turned by chemical means, but from which it cannot readily be obtained. In 1806 Napoleon instituted a blockade under the Continental

System, prohibiting trade with Britain from any Continental port; and in 1807 the British Government replied by the Orders in Council prohibiting trade with any port occupied by the French. This state of matters continued until 1814, paralysing commerce, but leading to enormous development of Continental manufactures; and the beet became the great source of sugar in France and Germany. Although after the peace of 1815 its use declined, it was revived in Germany in 1830; and, after slow progress to 1840, beet farming increased in importance and productiveness by enormous strides. Selective cultivation increased its sugar-bearing qualities; its culture was regulated with scientific exactness to the smallest detail, and constancy of composition and character ensued. At present the cultivation of sugar-cane is being carried on with renewed vigour in its eastern home, India. Java, and the East Indian Islands generally, produce large quantities. It has taken firm hold in Africa and Australia; in fact, in Queensland sugar is now an export second in value only to wool. Were it not for this increase in the southern hemisphere, the days of the historical sugar-cane would be numbered. Not only did the beet sugar manufactured in 1884-85 amount to 2,546,000 tons, as against 2,260,000 of cane, but it was proved by experiments in the same year that beets for sugar-making formed a more paying crop than wheat in some of the richest agricultural districts of England. By certain improved processes of manufacture sugar is being prepared from the sorghum cane, and from maize in America, and the former has been successfully cultivated in Hungary. The manufacture is not yet an assured commercial success, but any advance in the price of sugar would make it so, as the plant has an enormous geographical range. For many purposes, including adulteration, glucose, which is prepared in great quantities in Germany from starch, is found to be of equal value with saccharose or cane-sugar, and very much cheaper. The attention of science has long been directed to the synthesis of saccharose, and in 1885 two German chemists announced that they had effected this by passing an electric current through a mixture of starch, sulphuric acid, and water; but I have been unable to ascertain whether the process is a commercial success. A new source of anxiety for the sugar-grower has arisen in the last few years in Remsen's *saccharine*, a substance obtained from coal-tar, as different from sugar as two substances can well be,¹ but possessing the property of intense sweetness without any nutritive value. It is made on a large scale by Fahlberg in Germany, and, so far as sweetness is concerned, it is nearly as cheap as beet-sugar—i.e. the price is about 300 times greater, and the substance nearly 300 times sweeter. It is hardly likely, however, that this chemical compound, benzoylorthosulphonic imide, will for a long time to come successfully compete with the natural product to which we are accustomed.

A glance even so brief as this shows us how the substance sugar has

¹ Dr. Yeats, in his *Natural History of the Raw Materials of Commerce*, confounds saccharine with saccharose, and consequently is led to a very sanguine view as to its success as a marketable product.

changed in its geographical relations. At first it was drawn solely from a tropical plant, necessitating conditions of labour from which the conscience of the nations—not of the planters—ultimately revolted; then for a time by the chances of war it was extracted from the vegetables of the temperate zone; exhausted soils and diminished labour in the west drove the reviving cultivation of the cane to the eastern tropics north and south of the Equator; but Northern and Central Europe have become the main source of supply, and possibly in the future processes will triumph which can produce it with equal facility in all parts of the earth from purely inorganic materials.

Such changes emphatically teach the importance to the merchant of scientific foresight and historical retrospect, and the consideration of those conditions which, either naturally or when improved by art, can produce a desired commodity. Every change has been towards increased certainty and uniformity of supply. In the great markets goods can be imported from Germany much more easily than from South America; the manufacture can be regulated better, and the balance of supply and demand more easily adjusted. The tendency in all manufactures is to relinquish distant fields for near ones, and as far as possible to substitute artificial for natural sources of supply. Already madder has been almost driven from cultivation by the preparation of its identical colouring-matter, alizarine, from coal-tar; indigo is similarly threatened, and so many chemists have so long been labouring at the synthesis of quinine that that product must soon be produced artificially, and cinchona-planting follow the way of madder-farming. It is on viewing such tendencies that I see the importance of combining Technology to a certain extent with Commercial Geography. Many generations will probably pass away before the laboratory and the chemical-works entirely supplant the farm and the plantation in producing such things as sugar, alcohol, tea, drugs, and dye-stuffs; and in the meantime the conditions of natural culture for these in all regions must be studied more and more attentively, and the methods of production made more and more complete and economical, so as to compete as long as possible with synthesis. For this purpose a knowledge of the physical conditions of the earth is absolutely essential; and it is even more necessary in enabling a cultivator to recognise new products of value, and to judge when the time has come for placing all land under the grand necessities that we can see no prospect of ever producing artificially. Grain, flesh, wool, silk, cotton, timber, must continue to be raised indirectly from the earth through the agencies of vegetation and animal life, although it is quite possible that glass, slag, and asbestos may some day become a formidable rival to the textile fabrics in producing clothing, and wood be as unnecessary in the construction of our houses as it is in building our ships.

Another purpose is to be served by the study of Applied Physiography. The absolute certainty is forced on one that in nature nothing can be obtained except for its exact equivalent, that no short cuts can be of any

permanent benefit, and that any temporary advantage is only gained at the expense of a far more widespread loss. The mixing of goods with inferior material without mentioning it; speculation in commodities that have no real existence; in general, the conception of trade as a sphere outside of morals, lead to brilliant fortunes sometimes, but in the long-run they work incalculable woe. No knowledge, even the most complete, of "the earth beneath, and the waters under the earth," is of permanent value to humanity, unless it is applied with wisdom, and according to the principles of justice. To send to Africa, for the sake of a slightly larger profit, a cargo of adulterated intoxicating liquor instead of a load of manufactured cotton, is not only morally a crime—it is commercially a blunder; perhaps even a greater blunder than the transport of the first load of Negro slaves to the West Indies, and ultimately to be fraught with as heavy a penalty. Mr. Somers, in his admirable sketch of Commerce in the *Encyclopædia Britannica*, clearly summarises the modern condition of things: "Easy transport of goods by land and sea, prompt intelligence from every point of the compass, general prevalence of mercantile law and safety, have all been accomplished; and the world is opened to trade. But intellectual grasp of principles and details, and the moral integrity which is the root of all commercial success, have to be severely tested in this vaster sphere."

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

THE Annual Business Meeting of the Society was held in the Merchants' Hall, Edinburgh, on 21st November at 4.30 p.m. The Right Honourable Sir Thomas Clark, Bart., Vice-President, presided. Mr. A. Silva White, Secretary, submitted the Report of Council for the past session, which, on the motion of Principal Grant Ogilvie, seconded by Sheriff Mackay, was adopted by the Society. On the conclusion of the Report, Mr. William C. Smith, Advocate, made the suggestion that, in addition to the public meetings of the Society, others of a more domestic character might be held, at which there could be some discussion among members of the Society on great questions of Geography. This suggestion was received with approval. Dr. George Smith moved the first Resolution, which was as follows:—

RESOLUTION I.

- (1.) "That the President and Vice-Presidents be re-elected, with the addition of the following Vice-Presidents:—The Right Honourable the Earl of Camperdown; the Right Honourable the Earl of Hopetoun.
- (2.) "That the Honorary Secretaries, Treasurers, and Map-Curator be re-elected; and that Mr. David Petrie be elected Honorary Librarian in place of Mr. William C. Smith, resigned.

- (3.) "That in the room of Members of Council retiring at this time, the following be elected Members of Council, viz. :—Dr. George A. Turner, Glasgow ; Mr. Hugh A. Webster ; Mr. H. M. Cadell ; Mr. John Cockburn ; Principal Grant Ogilvie ; Sir J. N. Cuthbertson, Glasgow ; and Mr. J. Y. Buchanan : and that the following Members of Council be re-elected, viz. :—Mr. James Currie ; Dr. W. G. Blackie, Glasgow ; Mr. Adam W. Black ; Principal Peterson, Dundee ; Mr. David Patrick ; Dr. A. B. M'Grigor, Glasgow ; Dr. Thomas Muir, Glasgow ; Professor Calderwood ; Mr. H. J. Younger ; Dr. Alexander Buchan ; and Dr. Hugh Cleghorn."

This resolution, having been seconded by Colonel Dods, was adopted.

On the motion of Mr. James Currie, seconded by Sir Alexander Christison, Baron Adolf Erik Nordenskiöld was elected an Honorary Member of the Society. The Secretary read the following short biographical notice of Baron Nordenskiöld :—

"Baron Adolf Erik Nordenskiöld was born at Helsingfors, the capital of Finland, on 18th November 1832. Under the tuition of his father, who was at the head of the Finland Mining Department, young Erik early acquired a taste for the kindred sciences of mineralogy and geology. Having completed his education at the Gymnasium at Borgo and the University of Helsingfors, he was nominated to several appointments connected with mining. In 1851, and again ten years later, he accompanied Torell to Spitzbergen ; during the interval he was Director of the National Museum at Stockholm. In 1864, Nordenskiöld headed another expedition to Spitzbergen, for the purpose of completing the measurement of an arc of the meridian, which had been begun in 1861. On this occasion (1864) he mapped the southern part of Spitzbergen. In 1868, with the Government steamer *Sofia*, Nordenskiöld reached the high latitude of 81° 42' N. Encouraged by this success, he, four years later, once more visited Spitzbergen, intending to spend the winter there and push on higher by sledges. But circumstances prevented the original plan being carried out, though, with Lieutenant Palander, he was able to survey part of North-East Land.

"Nordenskiöld next turned his attention to the North-East Passage, and in 1875 navigated the Kara Sea to the mouth of the Yenisei, which river he ascended in a small boat, and returned home overland *via* St. Petersburg. In the following year he again voyaged as far as the Yenisei and back, by sea. These were, however, but preliminary trips to his famous work in the *Vega*. In July 1878 he started in that vessel, and doubled Cape Tchelyuskin, the northernmost point of the Old World, and wintered in Behring Strait, where the party were compelled to stay until July 1879. They reached Japan on September 2d of the same year, thus completing the North-East Passage. On his return to Europe, Nordenskiöld was created a baron (April 1880), and received many marks of distinction from foreign governments and influential societies."

The Secretary having read to the meeting the recommendations of Council in regard to alterations in, and additions to, the laws of the Society, intimated that these would be submitted to the Society at a Special Meeting on the following day.

The Special Business Meeting of the Society was held in the Merchants' Hall, Edinburgh, on the 22d November, at 4.30 p.m., Mr. James Currie presiding. Mr. Ralph Richardson submitted the following recommendations from Council with regard to alterations in and additions to the laws of the Society, whereof notice was given at the Annual Business Meeting held on the previous day :—

"In Law I.—That the word 'Royal' be prefixed to the words 'Scottish Geographical Society.'

"In Law XXIII.—That the word 'seven' be substituted for the word 'nine.'

"And that the following new Chapter and Laws be enacted, namely :—

" CHAPTER VII.

" DIPLOMAS.

"XXXVI.—The Council may confer the Diploma of Fellowship on persons who have rendered services to Geography or to the Society as follows viz. :—

"(a) *Without Fee*, on distinguished travellers or Geographers, or on Honorary and Corresponding Members of the Society who intimate their willingness to accept it.

"(b) *On Ordinary Members* who have paid a composition for Life Membership, or who have paid three Annual Subscriptions and are not in arrear, on their applying for it in writing, and on payment of a Diploma Fee of One Guinea.

"XXXVII.—Each Diploma, after being approved by the Council, shall be signed by the President or one of the Vice-Presidents, and by the Honorary and Acting Secretaries of the Society.

"XXXVIII.—Members who receive the Diploma shall have the privilege of designating themselves 'Fellows' of the Society, and may use the initials 'F.R.S.G.S.' after their names as long as they continue to be members of the Society."

The recommendations having been read, the Chairman moved their adoption. Mr. J. Y. Buchanan seconded the motion. The Rev. Thomas Downie took exception to the manner in which the diplomas were proposed to be given to Ordinary Members, and moved that there should be an examination which such members should pass before being entitled to the diploma. Mr. Alex. Kirkwood seconded this amendment to the Chairman's motion. After a discussion the Chairman put the amendment to the meeting, when 3 voted for it (viz., the mover and seconder and Sir Alexander Christison). He thereafter put his motion, when 26 voted for it; he therefore declared the motion carried. The above Recommendations from Council thus became law.

The Glasgow Branch of the Society held its Anniversary Meeting in St. Andrew's Hall on the evening of 22d November, Dr. W. G. Blackie presiding. Sir Charles Bernard, K.C.S.I., late Chief Commissioner of Burma, who this year was invited by the Council of the Society to deliver the Anniversary Address, delivered a lecture on "Burma: the new British Province." After the lecture, a vote of thanks having been awarded to Sir Charles Bernard on the motion of Sir James Bain, a series of lantern slides, kindly lent to the Society by Mr. Henry Soltau, were exhibited by the lime-light apparatus.

Sir Charles Bernard repeated his address on "Burma" at the Anniversary Meeting of the Society in the Queen Street Hall, Edinburgh, on the evening of the 24th November. Principal Sir William Muir, Vice-President, presided. The address, as in Glasgow, was illustrated by the lime-light views of Burma lent by Mr. Soltau. Dr. George Smith moved, and Mr. Henry Soltau seconded, the vote of thanks to the lecturer. A brief report of their speeches, and of Sir Charles Bernard's reply, will be made when the paper on "Burma" is published. Sir Thomas Clark moved a vote of thanks to Sir William Muir for presiding.

GEOGRAPHICAL NOTES.

AFRICA.

Mr. W. Montagu Kerr sailed last month for Zanzibar. It is Mr. Kerr's intention to cross the continent of Africa from east to west. The route he intends to follow lies through Masai Land, and past the northern extremity of the Victoria Nyanza to Wadelai, the headquarters of Emin Pasha; and his present intention is, we learn, to explore the region of Lake Chad, and to reach the West Coast by the Niger.

M. Duveyrier in Morocco.—This experienced and indefatigable African traveller undertook as the object of his last journey to explore a portion of the north of Morocco, hitherto almost entirely unknown. The region in question lies between the Mediterranean and Cape Et-Taza, and extends over a distance of 200 miles in length. Of this M. Duveyrier was only able to traverse about one-third, embracing the country of the Izenases, the plain of Terifa, Kebdana, and a portion of the country of the Guela'aya. The plain of Terifa, which lies between the mountains of Izenases and the hills of Kebdana, outliers of the basaltic range of Guela'aya, stretches down to the Mediterranean. It partakes of the leading characteristics of the Sahara, especially in respect of its vegetation; and it has also moving sands and shotts, like those of Biskra in Algeria.—*Soc. de Géogr. de l'Est*, 2^{me} Trimestre, 1887.

Emin Pasha in Monbuttu Country (*continued and concluded*).—At Tingasi Emin Pasha stayed several days, receiving the chiefs of the A-Sandeh and the Monbuttu in audience, returning their visits, reorganising the administrative machinery of the country, and making all kinds of observations and collecting specimens. With his love of natural science, which is one of the most conspicuous traits in the character of this very able man, Emin combines not only the qualities of a close and accurate and painstaking observer of details, but also a power of generalisation of no mean order; such, in fact, as we should expect from a man of his recognised administrative ability. He states, with respect to the Monbuttu country, that the fauna, in its distribution and the general type of its species, is exactly analogous to the flora, which, as Dr. Schweinfurth concluded, does not belong to the northern portion of the East African region, but rather to the tropical west. So of the zoology, he says: "Although a great number of forms from the north and east find their way into these districts (the Monbuttu country), yet the bulk of the fauna in respect both of its appearance and its affinities, is more allied to that of the west and south. The presence of the anthropoid apes—and, I believe I am right in adding, a species of lemur, the appearance of *Atherura*, *Potamocheirus*, *Anomalurus*, etc., and of quadrupeds; the frequency of several species of *Turacus* and *Musophaga*, of *Nectarinia* and *Tricophorus*—all this proves conclusively that we have entered the forest region. But as the steppes penetrate some distance into the forest region, they take their peculiar faunal inhabitants along with them, and so it comes to pass that the grey *Schizorrhis zozura* is found side by side with the gay-clad *Corythaix*, and such humble forms as *Cantropus monachus* alongside of parrots and *Bucconidae*."

The return journey was commenced along the same route as that followed in going to Tingasi, except that the Pasha himself made a deviation for the purpose of paying a visit to the influential chiefs Jangara and Sanga. But on reaching the neighbourhood of Gambari's village, he was met by a

messenger with the unpleasant news that in the midst of peace the Danka peoples, the Nuehr and Agahr, had in combination attacked the station of Rum-behk in the Bahr-al-Ghazal country, slain the garrison and inhabitants, and carried off all the fire-arms and ammunition they could find. This message quite upset all Emin's plans. Instead of proceeding further to the east as he had intended, having had people collected at Loggo for that purpose, he now sent directing them to return to the north, whilst he himself, with only one attendant, hurried off diagonally across the Niam-Niam country, so as to strike the western half of Makraka. The Kibali or Wellé was reached at a point about 110 yards west of the confluence of the Dongu, being there $14\frac{1}{2}$ feet deep and 90¹ yards wide. An island of some size lies in the river athwart the mouth of the Dongu. A thermometrical measurement, taken under somewhat unfavourable conditions, gave the altitude at this spot as 2172 feet. The native guides under whom the energetic Pasha placed himself after crossing the Wellé lost their way, and led him by a long detour through a country covered with tall waving grass the sharp edges of which cut through even leather clothing, and plentifully studded with marshes and pools, to Bongereh's village, one hour north of the Dongu. The soil of this district is mostly red ferruginous clay, containing many conglomerates, and in the creases of the rumpled surface a muddy humus mingled with fine grey sand. North of Bongereh's village Emin again entered the marshy country cut up with numerous streams which he had traversed on his way southward. This region constitutes a broad belt of "infiltration marshes," lying along the southern slope of the Makraka highlands. The Akka was crossed at a point where its steep banks are 13 feet high, its yellow waters 65 feet wide and 8 feet deep. The route then led past the Bumango range, the first step upwards to the Makraka highlands, the foot of which is washed by the Sansa, a tributary of the Mogbomu, which flows into the Akka. Beyond the Sansa, a stream some 40 feet wide and 5 feet deep, the configuration of the country became more hilly and the gneiss began to make its appearance. The countries of the Abaka and Mundu, which were the next traversed, have a rolling surface covered with dense tall grass, which is so strong and sharp-edged as to be almost impassable; and the ridges and more elevated tracts are clothed with almost impenetrable jungle. The narrative breaks off with the writer's arrival at the station of Tomayá in the Abaka country, where he halted to await his people from Loggo. In this neighbourhood he notices the large number of larks (*Geocoraphus modestus*) and yellowhammers (*Emberiza septemstriata*), an *Ambliospiza*, and a new species of *Lamprocolius* which had only been met with before in Monbuttu; and a tree frog,—a decided rarity.

The journey seems to have been undertaken in the middle of what would be our summer, and the season was one of great rains. The streams were all swollen, especially on the return, when the Dongu was found to have overflowed its banks and flooded large tracts of the adjacent country. The principal part of the heavy precipitation seems to have fallen to the east and south of the regions traversed by Emin Pasha—that is, over the head-waters and sources of the majority of the rivers, which have for the most part a westerly flow. However, judging from the fact that the Nile at Lado during the same season (1883) rose to a greater height than usual, it would seem that the rainfall was above the average.—*Verhandlungen* of Vienna Geog. Soc., Bd. xxx., Nos. 7-9.

Lake Shirwa.—Consul O'Neill, our Honorary Corresponding Member at Mozambique, forwards us a letter he has received from the Rev. Alexander

¹ On page 595 "800 yards" should be "80 yards."

Hetherwick, describing very briefly a journey made by Mr. Hetherwick to the north of Lake Shirwa or Kilwa, from his station of Domasi, upon the eastern side of Zomba, East Africa. From this letter we make the following extracts:—

"I went," says Mr. Hetherwick, "round the north side of Chaoni, and along the base of Chikala, leaving Kawinga to the right, and struck the north shore of Shirwa at the Ngande river, and then followed the wooded ridge that runs along the northern shore, examined Ntorendenga swamp, passed northwards to Cheuta, and down the Lujenda to Lake Namaramba. I did not go beyond Chikwajo's village, who has come to that district since you were there: I saw Chiminas' on the other side, where you camped and took your lunars.

"I do not think there can be anything to add to your report, except a few details. I found a small stream running into the Ntorendenga swamp from the north, but scarcely worth noting. There can be no drainage from Shirwa into Cheuta, so any theory of mine on that subject has gone to the winds. There may be a slight oozing from Ntorendenga into Shirwa, but that is all. The three lakes are quite distinct, as you say; Cheuta and Namaramba being separated by the part of the Lujenda called Msimbiti, as in your map. Namaramba was very low this year, but Cheuta is quite plain as a wide sheet of water even in the dry season. I kept close to the Msimbiti all the way to Namaramba, and got latitudes of the north end of Cheuta and the south end of Namaramba. The Msimbiti is overgrown with grass, so that no water can be seen at this time of year (July and August), and the sides of Namaramba are also very marshy from the lowness of the water. The only point that I could not satisfy myself about was the existence of a small river running from the hills on the north into Cheuta along with the flow from Ntorendenga. This is a stream they call the Mpiri, but you have not mentioned it in your notes nor inserted it in your map, so I cannot say how it goes. You must have crossed it if it existed, so I am in a puzzle regarding it, and had no time to go and see."

Mr. Hetherwick's theory, mentioned above, in regard to the outflow from Shirwa, was referred to by Consul O'Neill in his paper on "East Africa," p. 341, vol. i. of this Magazine. Consul O'Neill first disconnected Shirwa from the Lujenda drainage system, and the evidence of Bishop Smythies of the Universities Mission, published in the *Journal* of the Manchester Geographical Society, and now of Mr. Hetherwick, more than confirms what Mr. O'Neill said in his paper published in the *Proceedings* of the Royal Geographical Society for November and December 1884.

Cameroon (German).—In a supplementary number of the *Kölnische Zeitung* for 9th October 1887, the energetic African traveller and special correspondent of the newspaper named, Herr Hugo Zöller, gives a history of exploration in connection with the German Crown colony of Cameroon. He adds a large-sized map, which is not only very useful for showing the position of places already known, but more serviceable perhaps for showing how extensive an area still remains to be explored. With the exception of a fringe along the coast, 60 or 70 miles wide, and the course of the river Campo on the south of the colony, the entire region inland is a complete blank. One or two isolated points are, however, marked in the extreme north-east, having been visited from Adamawa. The first Europeans to acquire any knowledge of this part of Africa were Portuguese mariners. These were followed by the English, Burton being the first to ascend the Cameroon Mountain, whilst the lower portions of most of the rivers, as far as the rapids, were visited and explored by missionaries, merchants, doctors, and others, among whom Saker, Grenfell, Allen, and Comber were conspicuous.

Our knowledge of the country was then increased by the Germans, Buchholtz and Reichenow, and a decade later by the Poles, Tomczek and Rogozinski; and lastly, since the German occupation, these have been followed by the explorers Nachtigal, Buchner, and Zöller. Robert Flegel, at the time of his death, was engaged in a project for penetrating from Adamawa southwards to the Cameroon river, and so on to the Gulf of Guinea coast. Besides the explorers already mentioned, Dr. B. Schwarz and Dr. Zintgraff have both made unsuccessful attempts to advance towards the north-east in the direction from which Flegel proposed to come. At the present moment there are two lines of march to be explored, the opening-up of which are of urgent importance, not only as affecting the development and future of the colony, but in their relation to the geography of Western Equatorial Africa. One is that already indicated, between Cameroon and Adamawa, the other extends from the river Batanga to the Congo. Thorough exploration in these two directions would solve the following problems, or at any rate probably contribute materially to the solution of them: Does the volcanic Cameroon mountain-range extend further in the interior towards the north-east? Whence come the numerous rivers which reach the sea in the Gulf of Biafra? Are they navigable above the rapids, with which our knowledge of most of them now stops? Is there any through-communication by water with the Congo basin? Can any market be found in the interior for merchandise imported by way of Cameroon? The difficulties which lie in the path of explorers to the interior are not confined to the obstacle presented by the rapids in the rivers: far greater hindrances are placed in their way by the unwillingness of the coastal tribes to render them assistance. These tribes have a monopoly of the trade with the tribes of the interior, whom they jealously prevent from coming down to the coast, and from whom they are equally anxious to keep the Europeans; and hitherto no expedition has been sufficiently strong to force its way through their fringe of territory. Messrs. Kund and Tappenbeck are now on their way to attempt the exploration of the country between the Batanga and the Congo. (We also learn from another source that Dr. Zintgraff and Lieutenant Zeuner are about to establish an observational station at Lake Elephant.)

Dr. Zöller again restates in the present paper the hypothesis which he has previously advanced, to the effect that some of these rivers of Cameroon may perhaps be the delta mouths of some gigantic stream of the interior. And he claims that his hypothesis is fully confirmed in the case of the Rio del Rey, which marks the frontier between the German and English possessions. The lower course of this river has been ascended by two German expeditions, first by the commander of the warship *Habicht*, and then by the Governor of the colony, Herr von Soden. From an account of the latter journey, we extract the following particulars:—The depth of the river is some 23 to 26 feet. Its banks are swampy and covered with mangrove trees. About 25 miles up stream the river bifurcates. The arm which comes from the north-east again splits some 18 miles from the bifurcation into three branches. At this point the water was decidedly saline, and a fluctuation of 10 to 12 feet was noticeable between ebb and flow. Some 11 miles up, the north-western arm divided into two branches, of which one came from Calabar. From these facts Herr Zöller infers that the Rio del Rey is in all likelihood not an independent river with sources of its own, but merely one of the anastomosing branches of the Calabar delta.

The only trustworthy meteorological observations which have been systematically made in the Cameroon country are those taken on board the *Habicht* in 1885 and 1886. The maximum temperature observed in the harbour of Cameroon was 87°·98 Fahr., the minimum 71°·25; whilst out in the roadstead

the maximum was $84^{\circ}74$, and the minimum $73^{\circ}4$. In the year there were 156 days on which rain fell ; it must, however, be mentioned that sudden rain-gusts are as frequent as continued rains are uncommon.

AMERICA.

Gulana.—*M. Coudreau*, the French traveller, writing from Cayenne in June last, announces the discovery of gold in some abundance on the left bank of the river Aua, a right-hand tributary of the Maroni, in a region lying between the river Aua and the Tapanahoni. This region, some 7500 to 9500 square miles in area, is claimed both by the Dutch and by the French. It is inhabited by 4000 or 5000 Negroes, almost independent, and divided into two tribes. Beyond the settlements of these peoples, in the highlands of the interior, dwell three Indian tribes—the Rucuyennes, about the sources of the Aua ; the Trios, on the upper part of the Tapanahoni ; and the Oyaculets, a race about whom some degree of mystery clings ; they are said to have fair skins, with blue eyes, and a light-coloured beard, and dwell between the two rivers named, between the third and fourth parallels north. On the 19th of July, *M. Coudreau* intended to leave Cayenne, and steam and canoe up the Maroni, until he should reach the district of the Rucuyennes, on the northern slopes of the Tumac-Humac Mountains, at about the intersection of $2^{\circ}30'$ N. lat., and 56° W. long.—*Bull. Soc. de Géogr. Comm.* (Paris), tome ix., No. 7.

The Names of Guatemaltecan Towns.—It is uncertain whether at the present day any of the aboriginal names of places survive, for the successive invaders from the north or from beyond the seas, if they did not utterly destroy towns, imposed new names on the conquered places. We speak of the ruins of Palenque or of Quirigua, but we do not know the former names of these places, and call them, for convenience, by the name of the nearest modern village. Much ingenuity has been expended in the derivation of Indian names still extant, even the name of the Republic itself being one of the undetermined ones ; for, while Guatemala is undoubtedly taken from the name of the Cakchiquel capital, Tecpan Quahtemalan, it is not known whether this was named after Prince Jieutemal, or indeed whether the prince of that name ever existed. *Quiché* is derived from *qui*, “many,” and *che*, “trees ;” or from *queche*, *quechelau*, meaning “a forest”—an inappropriate name now. No less questionable are the derivations of *Tucurub*, “town of owls ;” *Es (Itz) cuintla(n)*, “land of dogs ;” *Izmachi*, “black hair ;” and many others.

The termination *pan* means “a standard,” or “chief place ;” hence, *Mayapan* of the Mayas, and *Totonicapan* of the Totonagues. *Tepec* is a “mountain,” or “high place ;” hence *Alotepeque*, *Coatepeque*, *Olintepeque*, *Jilotepeque*, and *Quezaltepeque*—all of them in mountainous regions, the second being a volcano of considerable height. *Tlan* means a “city,” or “home ;” hence *Atitlan*, “the home of the old woman (Atit),” *Zapotitlan*, etc. The most common termination is *tenango*, a Mexican word with much the same meaning as *tlan*, *Huehuetenango* being equivalent to “the ancient abode ;” *Chimaltenango* to “the house of the shield.”

A troublesome matter is the varying and uncertain orthography of most of the names now in use. *Goattemala*, *Gautemala*, *Guatimala*, are all used by writers. The termination *pan* is often in official publications spelled *pam*. *Quezaltenango* is properly, though seldom, written *Quetzaltenango* ; and *Cumarcab* or *Gumarcab*, *Izabal* or *Yzabal*, *Jutiapa* or *Xutiapa*, are common variations. The omission of the letter *n* in such words as *Montezuma* and

Montagua, and at the end of Escuintlan, is the rule in Guatemala; but foreign writers do not always regard it. The interchange of *b* and *v* is common, as *bejuco* or *vejuco*; *benta* or *venta*. So far as sound goes, the name of the large macaw may be *Juacamalla* or *Guacamaya*. *Tzololá* was one form of *Sololá*; *Taltic* of *Tactic*; and *Mictlan*, of *Mita*. It is quite possible that Soconusco is derived from *xoconochtili*, a word meaning "wild figs," and Honduras from *fonduras*, meaning "depths," although the application may not be clear at the present day. More satisfactory are *Michatoyatl*, "a river abounding in fish;" *Paxa*, "water which separates," the Rio Pax or Paz having always been the boundary between Guatemala and San Salvador. *Tonalá*, the "City of the Sun," and *Gumarca(a)h*, "ruined houses," are generally admitted to be correct derivations.

The Spanish invaders exhibited slight inventive powers, and some half a dozen saints were made godfathers and godmothers to all the Indian towns that were important enough to be rechristened; and Santos Juan, José, Tomas, and Marcos, and Santas Maria, Lucia, Anna, and Catarina are the favourites, although Pedro, Esteban, Jago, Miguel, Antonio, Christoval, Pablo, Izabal, and Clara are by no means neglected. The proper name of the capital city of Guatemala is Santiago (St. James); and if the ambitious projects dear to the late President Barrios should be accomplished, as seems not improbable, England will have to be satisfied with St. George, and leave "The Court of St. James" to the Central American kingdom. To the Anglo-Saxon such names as True Cross, Holy Cross, Thanks to God, City of Angels, Nativity, and Holy Saviour, seem wholly inappropriate as names of places; but to the devout Spaniard they were evidently favourite appellations. Nor are they very different from Praise God Barebones, Faith, Prudence, and the like, which we know were not uncommon appellatives among the Puritans. — Extracted from *Guatemala, the Land of the Quetzal*, by William T. Brigham.

AUSTRALASIA.

Geographical Work in Western Australia, 1870-1886.—Under this title, *The Colonies and India*, of September 9, prints the text of an address delivered by the Honourable John Forrest, C.M.G., Commissioner of Crown Lands and Surveyor-General of Western Australia, before the Geographical Section of the British Association at Manchester, on September 2d.

Previous to 1870 Western Australia was almost isolated both from the other colonies of the Australian continent and from the rest of the world. In that year Mr. Forrest travelled from Perth to Adelaide, following a route that ran near the south coast, a little distance inland from the shores of the Great Australian Bight. One of the results of this expedition was the erection of a telegraph line connecting the capitals of Western and South Australia. This journey had also an important influence upon geographical exploration in Western Australia generally. It stimulated the spirit of investigation so far that between 1873 and 1876 several expeditions, starting from the telegraph line between Adelaide and Port Darwin, in the north of the continent, were sent out with the object of reaching the settlements on the western coast. Of these expeditions some were failures; but those led by Messrs. Warburton, Giles, and Forrest were brought to a successful issue.

First, Mr. Warburton, in 1873, left the trans-continental telegraph line at Alice Springs, in the vicinity of the MacDonnell Range, and, travelling in a general north-west, then west, direction, struck the De Grey River, which he

followed down to its mouth on the north-west coast, in about 20° S. latitude. The country traversed was covered with *Triodia*, and water was scarce. Warburton used camels as his animals of transport; but the difficulties of the march were so great that he was obliged to kill them for food.

In the following year (1874) Mr. Forrest himself set out from Champion Bay, half-way up the west coast, and, following generally the line of latitude 26° S., he came to the telegraph line at Peake Station, about 600 miles north of Adelaide and 2000 east of his starting-point. The journey occupied six months. "From Champion Bay," says the explorer, "for several hundred miles was through a fertile and well-grassed country, but, after the watershed of the rivers falling into [*sic*] the western coast was reached, I encountered the same inferior district crossed by Warburton farther north. I was not provided with camels, and had very great difficulty in making progress, owing principally to the absence of water. The country was slightly undulating, and was from 1500 to 2000 feet above the sea; it was covered with *Triodia*, grassy valleys of limited extent intervening; there was also a good deal of low, scrubby acacia and other trees, eucalypti being confined to the banks of the short watercourses. Here and there masses of hills stood out above the surrounding country, sometimes rising as much as 1200 feet above it. The prevailing rock in this country was the Tertiary desert sandstone so continually met with in Central Australia." This expedition also dispelled the idea, which had been entertained in some quarters, that in the interior of the continent there existed a large lake, the probable recipient of rivers rising on a watershed to the east of the headwaters of the Murchison River. On the contrary, it was found that the whole of the drainage waters of the interior were absorbed by evaporation and by the salt marshes which occur in certain localities. In some cases, however, these marshes are of enormous extent—for instance, Lakes Amadeus and Eyre, and rivers some hundreds of miles in length empty into them.

The next explorer who crossed from the telegraph line to the west coast was Giles, in 1875-76. He performed the journey twice—once, roughly speaking, along 30° S. latitude, the second time, travelling inland, along latitude 24° S. On both occasions Giles had the assistance of camels. He found the country to possess the same general characteristics as Warburton and Forrest had observed further north—"the same desert sandstone, the same *Triodia*, the same occasional grassy valleys, and the same difficulty in procuring water." In one instance he went seventeen days, covering a distance of over 300 miles, without finding any water.

The next important piece of exploration to be recorded is the journey undertaken by Alexander Forrest in 1879 from the De Grey River north-eastwards to Port Darwin. This region is on the whole well-watered and fertile. "The Fitzroy River was ascended and mapped as far as the Leopold ranges, which are about 2000 feet above the sea. It was found to be a permanent river, running through fertile alluvial grassy plains. One of its tributaries was named the Margaret, and was followed for over 100 miles to its source; and, after crossing the watershed, a large river named the Ord was discovered and found to empty into Cambridge Gulf. The result of this expedition has been the opening up of this portion of Australia, its occupation by flocks and herds, and the discovery of a paying gold-field. The whole distance between Roebuck Bay and Cambridge Gulf has since been carefully triangulated, and a good topographical map has been compiled." The geology of this portion of Australia has to some extent been examined by the late E. T. Hardman; its principal features are the immense basaltic Antrim Plateau, covering an area of 3000

square miles, numerous other outcrops of the same rock (basalt), carboniferous limestones and sandstones, and numerous gold-bearing quartz-reefs. In a river bed, in $17^{\circ} 20' S.$ latitude and $125^{\circ} E.$ longitude, not far from one of the numerous limestone ridges, Hardman discovered a fossil bone of *Diprotodon australis*, the first specimen of this gigantic extinct marsupial found in Western Australia.

"In 1883, and again in 1886," continued Mr. Forrest, "I visited extreme North-Western Australia. On the first occasion I travelled from La Grange Bay to the Fitzroy River, ascended it as far as the St. George range, and also examined the country as far north as Port Osborne. This country consists of rich alluvial grassy plains, is well watered, is admirably suited for settlement, and is, in fact, being stocked with cattle, horses, and sheep. A township named Derby was established on the eastern shore of King Sound. In 1886 I had a similar duty to perform in founding a Government station, and selecting a township named Wyndham, on the east shore of the west arm of the Cambridge Gulf, and both these towns now bid fair to be places of much importance—Derby, on King Sound, being the outlet of the fertile valley of the Fitzroy River, and Wyndham, on Cambridge Gulf, the outlet for the fertile valley of the Ord, while both are the ports for the Kimberley gold-fields," situated about 250 miles inland.

British New Guinea.—We have received from our Corresponding Member, Mr. J. P. Thomson, Hon. Secy. of the Queensland Branch of the Royal Geographical Society of Australasia, the following notes, relating to the country in the neighbourhood of Mount Yule, a comparatively unknown district of British New Guinea, lying to the north of Hall Sound, and Yule Island, in the Gulf of Papua. A further knowledge of this district would be interesting from the fact (to which, however, the writer does not allude) that communications, and therefore a track of some sort, are credibly reported to exist between the natives of this part and those of the opposite (northern) coast of New Guinea:—"Mr. E. G. Edelfelt, F.R.G.S.A., and the Rev. Fathers Couppé and Verjus have examined the Mount Yule District, the former for the purpose of obtaining information as to the physical features of the district generally and its native inhabitants, and the latter gentlemen for suitable places to establish stations wherewith to further extend their missionary operations under the auspices of the Order of the Sacred Heart. They succeeded in reaching the foot of Mount Yule, which is about 25 miles north from Hall Sound, in lat. $8^{\circ} 21'$ south, and long. $146^{\circ} 39'$ east. Excessively wet weather and difficulty with the natives, on whose assistance they solely relied, prevented their ascent to the summit of the mountain, which Mr. Edelfelt thinks can be easily accomplished if done independently of the natives. The country from the sea coast to the base of the mountain is comparatively level, and can easily be traversed by pack-horses acclimatised to Northern Queensland. The explorers discovered an extensive valley of well-grassed and watered agricultural and pastoral country, said to be the most fertile hitherto discovered in British New Guinea. It is studded with a scanty eucalyptus forest interspersed with numerous belts of rich scrub-land, capable of yielding any variety of tropical produce, or affording excellent shelter for stock. Mr. Edelfelt thinks the Mount Yule District must eventually become most important for these purposes, owing to the richness of the soil, and the three rivers supposed to originate from Mount Yule, one debouching into Redscar Bay, one into the sea in the vicinity of Lese, and the third, the St. Joseph, into Hall Sound. This last river was so named by the Catholic Fathers of Yule Island. Some three years ago Mr. Edelfelt, when exploring in the Maiva district, crossed what is now called the St. Joseph River,

ten miles from the coast, and examined part of it. He mistook it at the time for the Hilda River, but in reality he is its real discoverer. Mr. Edelfelt, in a paper read before the Queensland Branch of the Royal Geographical Society of Australasia last year,¹ spoke in high terms of the agricultural and pastoral capabilities of the country lying between the foot of Mount Yule and the coast, and his assertions are fully verified by recent examinations. The Mount Yule district is inhabited by probably the densest population yet known in any one district in New Guinea, but the extent of land cultivated by them is minute in proportion to their numbers. The natives were kindly disposed towards the explorers, but at all times exhibited indications of suspicion. When traversing the upper section of the St. Joseph River, the explorers obtained a few specimens of quartz, which upon examination proved to be distinctly auriferous; it is therefore probable that a more extensive and detailed examination may result in the discovery of payable gold. The present season is reported to be very trying, owing to the unusual heavy rainfall and density of atmosphere, which conditions render this season altogether unfavourable for exploring, as progress is retarded, and no distinct views can be obtained of distant objects, all of which are enveloped in columns of dense vapour. As soon as the rainy season is over Mr. Edelfelt will endeavour to follow up the recent discoveries."

New Guinea.—The following appears in the *Melbourne Age* of 3d September:—"The object of the Victorian Royal Geographical Society in despatching Mr. W. R. Cuthbertson to New Guinea, to ascend the Mount Owen Stanley Range, has been accomplished, the following telegram having been received from the explorer:—'Cooktown, 3d September.—Returned safely, all well, having successfully ascended Mount Obree, Owen Stanley Range; but, owing to timidity of natives and their superstitions, was forced to return almost immediately, as nothing could prevent them clearing out from summit with all our belongings. Have pines, rhododendrons, etc., but, owing to above, collection is limited. Hartgan's (?) reports are totally unreliable, his greatest height being 2300 feet, and many days' journey from foot of range. Ours is the only expedition that has ever approached its base, let alone ascend one of its leading heights. Expect to arrive in Melbourne about the middle of October.—W. R. CUTHBERTSON.' It was desired that specimens of the flora of New Guinea should be obtained at various altitudes, and a careful report made on the mountain climate as affecting Europeans. This latter subject has not been touched upon by Mr. Cuthbertson in the short message he has sent, but on his arrival here his remarks thereanent will be of special interest. Exploring authorities evidently think much of his achievements, as witnessed by the following telegrams that have also been received by the Society:—'I congratulate your council on the brilliant success of Mr. Cuthbertson in the ascent of Mount Obree.—W. G. LAWES, New Guinea.' 'Cuthbertson, splendid success; New Guinea's best explorer; return him next year.—JAS. CHALMERS, New Guinea.'"

While willingly accepting Mr. Cuthbertson's account of his successful ascent of Mount Obree, and congratulating him on the same, we can by no means accept, without fuller information, his strictures on Mr. Hartmann's expedition. Mr. Hartmann, he says, never got near the main range, and only reached an altitude of 2300 feet. It is, however, quite possible that there may be a col in the range, between the Obree and Brown peaks, not exceeding 2300 feet. Mr. Hartmann claims expressly not only to have reached the range, but to have crossed to the eastern or further side. No doubt the distance—certainly not less than 50 or 60

¹ *Proceedings Queensland Branch R.G.S. Australasia*, vol. ii. Part i., 1886-7.

miles as the crow flies—to the other side and back in eleven days, is, considering the country and the delays encountered, a difficulty; but part of the return journey seems to have been made in a boat or raft. It seems a pity that all these recent expeditions have been so hurried; some really considerable results might have followed if the explorers had taken more time for their work. We learn that Mr. Cuthbertson has for the present season abandoned the idea of ascending Mount Owen Stanley itself, the peak of which, it may be remembered, is some 70 miles to the N.W. of Mount Obree, and 3000 feet higher. Mr. Cuthbertson assigns to Mount Obree a height (observed) of a little over 8000 feet—or 2000 feet under that given by the Admiralty.

MISCELLANEOUS NOTES.

M.M. Bonvalot and Capus have arrived in Paris from India.

Mr. H. O. Forbes has accepted an appointment until the end of the year as Meteorologist under the New Guinea Administration.

M. Rosset is about to undertake the systematic Exploration of the Maldivé Islands, a duty which has never yet been performed for them. These islands, some scores in number, are grouped in several atolls, the most important being Malé, on which is the residence of the Sultan, who rules the islands under the protection of the Government of Ceylon. The 150,000 inhabitants consist of Arabs, Hindus, Cingalese, and Malabarese, and their predominant language is Arabic.

The July issue of the *Verhandlungen* of the German Society for the Physiology and Ethnography of Eastern Asia, in Tokio (Japan), contains an elaborate discussion of *Census-takings in China and Japan*, from the pen of Herr P. Mayet. The author treats of his subject in almost all its aspects, embracing the history and methods of the census-takings, the duplication periods of the population, the birth-rates and death-rates, and the comparison of the population statistics of both countries with those of European States.

A letter from the German Ambassador at Buenos Ayres to the Berlin Geographical Society, printed in No. 7, vol. xiv., of the Proceedings of that Society, announces that in July last *Dr. Carl von den Steinen* arrived at Cuyaba, in the Brazilian province of Matto Grosso. From there he intended to penetrate, if possible, northwards into the region where the Xingu has its sources, and to proceed as far as the river Coliseu, in which district he proposed to spend the winter or rainy season, for the purpose of studying the Indian tribes in the surrounding country.

Correction.—In the paper on *Recent Physical Research in the North Sea*, vol. iii. pp. 385-398, the equivalents in fathoms of the metrical measurements are incorrectly stated. The following table gives the correct figures, which should be used throughout the article in question, see especially pp. 389, 390, 392.

Mètres.	Fathoms.	Mètres.	Fathoms.
0	0	50	27½
5	2¾	100	54¾
7·5	4	150	82
15	8½	200	109¼
22·5	12¼	300	164
30	16½		

NEW BOOKS.

- I. *The Solomon Islands and their Natives.* By H. B. GUPPY, M.B., pp. xvi. and 384. 1887. Price 25s. And, by the same Author,
 II. *The Solomon Islands: their Geology, General Features, and Suitability for Colonisation.* Pp. vii. and 152. 1887. Price 10s. 6d. London: Swan Sonnenschein and Co.

The painstaking and comprehensive character of these volumes, and the qualifications of the author for the work he has performed, make them a most important contribution to the geography of the Pacific. The chief islands of the Solomon group are among the largest in Melanesia, and although the interior of these, owing to the great distances to be travelled among a remarkably savage and suspicious population, are still to a great extent unexplored, the additions made to our knowledge by the author's researches are very considerable. Dr. Guppy has translated for the work before us the journal of Gallego, the pilot to the Spanish expedition under Mendaña in 1567, and he enters at some length into the interesting story of the long disappearance of the Solomon Islands after their discovery by that expedition—so long indeed that in many quarters their very existence came to be doubted. This was mainly owing to the Spanish practice of that day, of concealing their discoveries, either by suppressing the reports of commanders, or by falsifying their charts. Their object in so doing was, of course, not only to place their discoveries on the right side of the Papal Meridian, but to prevent their falling into the hands of Drake and other enemies; but the practice has in many cases diminished the fame of the early Spanish navigators—the fate of the records of Torres being a conspicuous example. As regards the Solomon group, the names given to the islands by the Spaniards have now mostly been restored, but their claims to the discovery lay long in doubt. A series of British and French navigators, 200 years after the Spanish expedition, ignorant not only of each other's work, but of their Spanish predecessors', independently rediscovered the group; but it was left, as Dr. Guppy says, for the French geographers, reasoning in their study on these discoveries, to identify them with the lost Solomons of Mendaña; our own geographer, Dalrymple (from national jealousy, Dr. Guppy thinks, but his reasoning, on the data available to him, seems cogent enough) maintaining that the Solomons were none other than the New Britain discovered by Dampier. The group, as may be seen on a modern chart, is composed roughly of two parallel chains of islands, enclosing a large and comparatively sheltered area of water, a circumstance, by the way, to which Dr. Guppy attributes the almost total absence, from the splendid canoes of this group, of the outrigger, which elsewhere in the Pacific forms the great protection against a capsize. The whole of the region where these islands are situated is one of upheaval, which is still in progress, and though this at present is gradual and uniform, and has not, since the discovery of the group 300 years ago, exceeded a few feet, the total rise cannot have been much less than 12,000 feet, the chief rock-formation below the recent coral being identical in composition with the deep-sea volcanic and calcareous muds forming at present in the neighbourhood of coral islands.¹ The great bulk of the islands are either of recent volcanic formation, with craters still hardly extinct, or are composed partly of modern and partly of ancient and

¹ The composition of this formation was discussed by Dr. Guppy in a paper read before the Royal Society of Edinburgh (*Trans.*, vol. xxxii. p. 3).

often highly crystalline rocks ; and even many of the smaller islands, which appear at first sight to be of purely coral formation, are found, on examination of their ravines, to have an underlying nucleus of such rocks. The structure of several of these lesser islands—which show a certain amount of uniformity—affords a most interesting illustration of the formation of atolls and reef islands. It may be objected, the author says, that such formation ought to be studied in an area of subsidence ; he holds, however, that the very reverse is the case, because here we have all the different stages of the process exposed to view by elevation. There is, first, the volcanic nucleus, either central, or sometimes eccentric with the subsequent accretions extending sideways from it. On this nucleus we find a partially solidified rock consisting of the calcareous or volcanic mud deposits above alluded to, and on this, when—whether by such deposition, or by gradual upheaval, or by both combined—the level is reached at which coral building can begin, we find a coral rock. In one instance Dr. Guppy found immediately overlying the volcanic nucleus a brecciated conglomerate, formed by the action of the waves wearing down the volcanic peaks to below the sea-level. It seems clear then that the condition of subsidence required by Darwin's famous theory of the formation of reefs and atolls is at all events not always necessary. Dr. Guppy notes, moreover, that he never found the coral rock of the vast thickness which might be expected on the subsidence theory. It was rarely, if ever, in his experience, of a thickness greater than what would represent the depth from the surface required by the coral builders. The plans and sections given (though the latter are only ideal) of some of the islands in question help to elucidate the writer's views. He speaks of the "great antiquity" of some of the crystalline rocks, but does not attempt to assign any definite age to them ; the traces of tin and copper which have been found may, however, afford some indications of this.

His description of certain ancient and disused flint implements occasionally found—pointing, he considers, to an earlier population than the present—is very curious, and the existence of such a population is perhaps corroborated by certain much-worn stone implements found in reef-rock, or at considerable depths in the soil, in Fiji. The presence of flints also raises the as yet moot question of the existence of a true chalk in this region. Dr. Guppy thinks that it may yet be found in the interior of the larger islands—a chalk-like rock, (without flints, however), has indeed been already found in close proximity to coral, a fact which, as the writer points out, has its bearings on the question whether the chalk was a deep-sea or a shallow-water formation. We have not left ourselves space to deal adequately with the writer's observations on the inhabitants, which are not less interesting or comprehensive than his account of the physical geography of the islands. While giving a description of a "typical Solomon islander," the fidelity of which will be admitted by any one personally acquainted with the race, he admits that it would be impossible to give a typical skull, for, speaking generally, the population may be resolved into two groups, the eastern and the western, the tendency in the former being towards dolichocephalism, while the index in the latter, which seems a darker and generally finer and more vigorous type, with straighter hair, is rather brachycephalic, or at all events not averaging under 78·7. Among this latter group a common language prevails to an extent uncommon in Melanesia, and the chiefs are more powerful than usual, the hereditary principle prevailing, which usually among these people indicates a more advanced condition than the slighter and temporary predominance depending on wealth or personal character.

Dr. Guppy gives the details of some investigation into the colour-sense of the

natives, the result being that, as a rule, they have distinctive terms only for white, red, yellow, and sometimes blue ; all the darker colours, as black, indigo, dark green, dark blue, violet, etc., are confounded, he tells us, under some common name. And yet, he says, they are able to match the seven colours of the spectrum ; and if the name for red " is but the native term for blood," and that for yellow the name of a common bulb with a yellow juice, they are, at all events in this respect, as far advanced as the races which use the terms orange, violet, mauve, and the like. If they have not studied the hues of the rainbow, it may be because, as the author says, this phenomenon is held to indicate the approach of hostile canoes, when they all retire at once into their houses.

There is no race in the Pacific which has so evil a reputation for treachery and savagery as this ; but although the writer found the interior of the larger islands closed to him for this cause, he seems to have met with uniform friendliness and hospitality in the other districts, often trusting himself entirely in the hands of the natives. The inveterate hostility and suspicion shown to Europeans are, as the author points out, only too well accounted for by the treatment they have received from white men from the time of their first discovery onwards, the only and consistent exception to this conduct being, he says, the Melanesian Mission. For much curious information on the habits of the people, we must refer our readers to the work itself, which also contains many interesting notes on the botany and other branches of natural history. The writer describes the effect of some experiments with the betel, or, more properly speaking, areca-nut, the effect of which seems to be much more intoxicating than is usually supposed, but he does not say whether on these occasions it was chewed with or without the betel-pepper leaf. He mentions a large number of plants which are used for food or otherwise, and is struck with the knowledge of plants which the natives possess, and the number, even of those which are applied to no purpose, which have names. He explains this by supposing that these names are useful for the purpose of distinguishing, by a process of exclusion, those plants which are of some use, but this theory seems hardly sufficient. He does not say that they have arrived at any classification of plants. Mr. H. O. Forbes, in his valuable book on the Malay Archipelago, says the natives there actually classify plants, applying a family as well as an individual name to them, and there is a sort of approximation to this even in Fiji. We have spoken throughout of the two volumes before us as one work. Practically they may be regarded as such, and we venture to think that their contents might with advantage have been so arranged.

Austral-Africa: Losing it or Ruling it; being Incidents and Experiences in Bechuanaland, Cape Colony, and England. By JOHN MACKENZIE.
London: Sampson Low and Co. 1887. Two vols. Pp. 515 and 525. Price 32s.

Mr. Mackenzie, in these two portly volumes, occupies himself with problems that are primarily political rather than geographical. He reviews with great force, and in much detail, that most perplexed and perplexing of colonial questions, the Government of Southern Africa—with British Bechuanaland as the foreground of his point of view, and recent troubles and complications there, in which the author himself was a leading figure—treating them as illustrative of the blunders of the past and as guide-marks towards a wise and more stable policy in the future. Into the subject of the portion of blame to be distributed between different races and different governments—between Europeans and natives, between English- and Dutch-speaking colonists, between South African agents

and Downing Street overseers, and between High Commissioners and Deputy Commissioners—in connection with the undoubted and grievous errors of judgment and action that have marked the course of our dealings with border questions at the Cape, it is not necessary to enter further than to say that Mr. Mackenzie marshals the heads of his indictment against Sir Hercules Robinson, and against the others who thwarted him in carrying out his plans for the pacification and administration of Stellaland and “Land Goshen,” with remarkable power and skill, supporting it with a formidable body of proofs, that he was in the main right, and they wrong, upon the points at issue. His main purpose is to enlighten opinion at home upon South African affairs, and more particularly with regard to the great value, commercially and politically, of the regions lying to the north of the Orange and the Vaal rivers, where we have at length definitely set down our foot; the danger of attempting to shirk, as has been done in the past, the responsibilities created by our position in South Africa, or of committing the directions of our border and native policy, for the present at least, to the tender mercies of Cape politicians and political influences; and the wisdom and necessity of undertaking to regulate and provide for the great northward movement of white settlers and traders, which at no distant date promises to reach the Zambesi. In all these matters, Geography is more or less directly interested; and first-hand knowledge of the countries destined to be the field of colonising enterprise, such as Mr. Mackenzie has already communicated to the world through the channel of the Royal Scottish Geographical Society, and embodies in his new book, is of the highest possible service in the solution of a problem which has hitherto, out of ignorance more than anything else, cost us so dearly in credit, blood, and treasure. Especially noteworthy is the opinion emphatically and repeatedly expressed by Mr. Mackenzie, that the new territory into which we have been reluctantly induced to enter will ultimately be found to be of greater value and importance than that included within the Cape Colony itself. This is wholly at variance with the views that have so long prevailed with respect to the physical conditions and agricultural and commercial resources of the country lying between the Orange and the Zambesi. An arid or desert region,—a “Great Thirst Land,” without permanent surface vegetation or regular rainfall or drainage system,—has been reported to extend north, and even in some parts south, of the former river, forbidding the advance in this direction of agricultural settlement, and limiting even pastoral farming within narrow bounds. Mr. Mackenzie, from his own observations and experience, declares that after giving all needful regard to the wants and rights of the native tribes, homes may be found in this region for many thousands of white settlers, and he points out the wonderful results that have arisen from the application of irrigation, the improvement of climatic and other conditions which is certain to follow the inflow of population and spread of cultivation, and the great, and so far barely touched, mineral resources of the country. The native chiefs, of whom Khame may be taken as a type, have shown inclination and even eagerness to be placed under the guardianship of the British flag, as a defence against the more unscrupulous advances of other civilised or semi-civilised neighbours; and the hesitancy which the Government have shown in accepting the protective charge of the whole possessions of the Bamangwato chief, and thus extending the limits of our South African Dominion to its “natural boundary,” the Zambesi, is condemned by Mr. Mackenzie as an act of weakness which, however, it is not yet too late to repair. Matabeleland also he regards as falling properly within the scope of our political influence and oversight, and he records interesting particulars regarding the disposition and customs

of the chiefs and people, the indications of wealth in gold and other metals, and the traces of earlier mineral workings, and a former civilisation to be found in this and adjoining native territories. Mr. Mackenzie's volumes are profusely illustrated and furnished with maps of Bechuanaland and South Africa. They deserve the careful perusal of every one who is in any way interested in "Austral African" politics, commerce, and geography.

Guatemala: the Land of the Quetzal. A Sketch by WILLIAM T. BRIGHAM, A.M.
London: T. Fisher Unwin, 1887. Pp. 453, including Appendix and Index.
Price 21s.

In many respects this is a model book of travels; in its arrangement the author has separated the trifling incidents of the itinerary of his journey from the more substantial and valuable information he was able to collect; the latter he has grouped under separate chapters, and these present the most praiseworthy features of the book. Indeed, considering how scanty are the means of reference for students of the geography of Central America, we are disposed to welcome Mr. Brigham's handsome volume with perhaps more commendation than it might otherwise command; for the author himself had to confront the same difficulty of obtaining information in regard to the country he was traversing. That this should be so is the more surprising when one considers the remarkable resources of the republics of Central America, and especially of Guatemala, and at the same time remembers the energy with which trade and commerce are pushed in other and less promising quarters of the world. The author, however, supplies a clue to this stagnation in the political and economical life of the states when he says: "Could these fermenting republics be induced to give up their absurd and expensive military establishments, and expend the money, now worse than wasted, in opening roads and teaching the people something besides military drill, the prosperity of this wonderfully fertile and agreeable region would be secured. Only their revolutionary habits now interfere with the introduction of foreign capital." As a sort of commentary on these words, we read only last month of a revolt in Guatemala, supported by the chief families of the Republic, having been quelled by the Government. When peace and order are established in this distracted country, perhaps the people may then realise what Mr. Brigham anticipates: "The time will come when these regions, far more fertile and accessible than those African wilds that for a score of years have interested, strangely enough, both explorer and capitalist, will claim the attention due their natural merits; and the fertile plains will be the garden and orchard of the United States—not necessarily by political annexation, but by commercial intercourse." Mr. Brigham writes as a United States citizen, and his opinion is that "all our sugar, all our coffee, all our chocolate, all our india-rubber ought to come from Central America, where these products can be raised better and cheaper than in any other country." "No country," he says, "on the northern half of the American continent has a finer climate or more beautiful and varied scenery, or is a more attractive field for the genuine traveller. Valleys rivalling the paradises of the islands of the Pacific; uplands not unlike the plateau of the Indian Neilgherries; forests as dense and luxuriant as those of Brazil; lakes as picturesque as those of Switzerland; green slopes that might have been taken from the Emerald Isle; glens like the Trossachs; desert wastes that recall the Sahara; volcanoes like *Ætna*; and a population as various as in that land whence came the Indian name,—all these features make but the incomplete outline of the Guatemaltecan picture."

This picture of the country the author has admirably portrayed with pen

and camera ; the illustrations to the book are specially deserving of notice, both for their varied selection and interest and the beauty of their execution. His route was from Livingston, the chief port on the Atlantic side, across the isthmus to San José, on the Pacific, and back by another way. The chapters in the Appendix, and those on the Republic in the olden time and at the present date, the vegetable and animal productions, earthquakes and volcanoes, are those which please us best. The publishers deserve credit for their share of the work.

China. By R. K. DOUGLAS, of the British Museum, and Professor of Chinese at King's College, London. Second Edition, Post 8vo. London : Society for Promoting Christian Knowledge. 1887. *Price 5s.*

In the book before us we have a short history of China and the Chinese, with a description of the government and some of the manners and customs of this remarkable people. We talk of the days of the Stuarts as the "Olden Time," and look with veneration at a piece of armour worn at Cressy, or the ruins of a castle built by the Norman conquerors. Here is a people whose recorded history goes back to the time of Abraham, who have books written forty centuries ago, and who can point to the Great Wall, still in tolerable preservation, which was begun 214 years before the Christian era—a people whose civilisation, such as it is, was as far advanced three thousand years ago as it is to-day, and whose "Book of Rites," written in the twelfth century before Christ, is *still* the ultimate appeal in all doubtful ceremonials. Professor Douglas describes in a pleasant style the peculiar customs of the Chinese, and their various rites and ceremonials, and discourses on the architecture, agriculture, language, literature, food, dress, etc. The book is well written, and worthy the perusal of any one curious about China and the Chinese, as the description is true and accurate in every respect.

Insulinde: Experiences of a Naturalist's Wife in the Eastern Archipelago. Pp. xii. + 305. By ANNA FORBES. W. Blackwood & Sons. 1887. *Price 8s. 6d.*

Readers of Mr. H. O. Forbes's valuable and interesting volume will probably remember a terrible and very nearly tragical episode of which Mrs. Forbes was the heroine. The adventures and difficulties encountered on this journey were trying enough for a man, but for a lady they are well-nigh unique, and Mrs. Forbes has certainly done well to tell the story from the feminine point of view. It must be remembered, too, that some of the places she described, and where their longest halts were made, as the Tenimber Islands, and the interior of Portuguese Timor, are quite unknown, and this lends additional value even to her personal experiences, which, however, she supplements on occasion by extracts from her husband's book. Her experiences give a good general impression of the life and surroundings of the traveller in these regions, their gorgeous beauty and picturesqueness, dearly paid for, not only by great discomforts, but by almost certain and often dangerous sickness ; and she has some curious and amusing notes on social matters, and details of costume, native and European, as well as of her own housekeeping under difficulties, which must be read to be appreciated. Messrs. Stanford's map of the Malay Archipelago, from Mr. Forbes's *Naturalist's Wanderings*, accompanies the book.

Loch Creran: Notes from the West Highlands. By W. ANDERSON SMITH. Paisley and London : Alexander Gardner, 1887. Cr. 8vo, pp. vi. + 332. *Price 6s.*

This is another welcome little volume from the facile pen to which we owe several works of a like nature. We refer to such charming little books as those

entitled *Off the Chain*—a work which chiefly relates to the regions of Tarbert and Islay; *Lewsiana, or Life in the Outer Hebrides*; and *Benderloch, or Notes from the West Highlands*. To this last volume, this of *Loch Creran*, complete in itself, forms an appropriate continuation, consisting of a monthly record of a further period of two years of continuous work and observation directed upon the myriad forms of life, and their surroundings in air, and earth, and sea, in the same inexhaustible district of Benderloch, between Lochs Linnhe, Creran, and Etive, in Argyllshire.

A Sketch of Geological History. By EDWARD HULL, M.A., LL.D., F.R.S., Director of the Geological Survey of Ireland, and Professor of Geology in the Royal College of Science, Dublin. London: C. W. Deacon and Co., 1887. Pp. 179. Price 3s. 6d.

Professor Hull is well known as a lucid and elegant writer on geology, and as an original authority on the difficult subject of the classification and mapping of geological periods. In this "Sketch" he leads the reader pleasantly through the long and complicated geological history of the earth, which he divides into six successive "ages," viz.—(1) The Archæan or Azoic Age; (2) the Lower Palæozoic Age (the age of invertebrates), comprising the Cambrian and Silurian Periods; (3) the Upper Palæozoic Age (the age of fishes), comprising the Devonian, Carboniferous, and Permian Periods; (4) the Mesozoic Age (the age of reptiles), comprising the Triassic, Jurassic, and Cretaceous Periods; (5) the Cainozoic Age (the age of the mammals), comprising the Eocene, Miocene, and Pliocene Periods; (6) the Neozoic Age, comprising the Postpliocene or Glacial Period (the epoch of the mammoth) and the Quaternary Period (the epoch of man). Such a "Sketch" as this also shows us how the sciences of Geology and Geography are intertwined. For instance, were a traveller to go to Madagascar he would find its fauna differ from that of the neighbouring continent of Africa. How is this to be explained? Professor Hull's "Sketch" supplies the reason. During Pliocene times occurred "a great migration of the larger animals inhabiting the northern (Europasian) continent into the southern, followed by the destruction or expulsion of the aboriginal inhabitants over the whole of Africa; owing to which they would have been utterly exterminated, had it not been that the survivors were left in possession of the island of Madagascar, as the wide and deep channel which separates it from the continent formed an impassable barrier. But the cause of this great invasion remains to be explained; it was in effect the approach of the intense cold, which reached its climax in the succeeding Postpliocene or Glacial epoch, and which converted the climate of, at least, the northern part of Europe into one approaching that of the Arctic regions at the present day. According to the views of Dr. Wallace, there were three causeways by which the migration of the animals from the north into Africa took effect—namely, by lands connecting Europe and Africa at the Straits of Gibraltar, at Sicily and Tunis, and at the Isthmus of Suez." The surface of the Mediterranean was also considerably lowered at this epoch, partly by the freezing of the northern rivers, partly by elevation of the land; and in this way Professor Hull accounts for "the large number of remains of elephants and hippopotami, and of other extinct mammals, in the caves of Malta and Sicily"—pointing to a time "when Malta stood in the centre of surrounding lands. Remains of hippopotami have also been found in the caves of Gibraltar." A carefully drawn geological section (coloured) accompanies the "Sketch."

The Australasian Colonies: Emigration and Colonisation. Report of Inquiries made by W. HAZELL and H. HODGKIN, during a visit to Australia, Tasmania, and New Zealand in 1886 and 1887. London: Stanford, and at the Emigrant's Information Office. Price 6d., pp. 89.

The Handy Guide to Emigration to the British Colonies. With Maps, by W. B. PATON. Society for Promoting Christian Knowledge. Price 3d., pp. 70.

We do not apologise for calling attention to these pamphlets, for the dissemination of practical information on the subject with which they deal is an object not unworthy the attention of a Geographical Society. To take the latter pamphlet first, it contains, besides maps of Canada, West Australia, and Queensland, a few statistics as to products, wages, and prices, and a copious list of emigration offices in this country, and of depots in the colonies, where further information may be had; all this is very useful. The report by Messrs. Hazell and Hodgkin has a wider scope, and deals shrewdly and sensibly, but without dogmatising, on the difficult question of the demand for labour; whether there is really an opening for emigration, and if so, for what classes of persons. The result at which the writers have arrived is that although, owing to the fact that Australasia has latterly, like the rest of the world, been having "bad times," there is *no general demand* for male labour, this is very different from saying, and by no means implies, that there is *no opening* for it. For agricultural labour in many districts there is an actual demand, and they would not dissuade any steady artisan, whatever his trade, from emigrating, if so minded. Even what are called "low wages" are equal to the average British wages, with board and lodging thrown in, while the cost of living is little, if at all, greater than at home. It appears that wages, as a rule, are kept at an artificially high level by the action of the Trades' Unions, which have great power, and the working classes are strongly opposed to immigration, except of persons with capital, as tending to lower the rate of wages. For female servants there is a steady demand. The writers show the unreality, speaking generally, of the "unemployed" movement. A large proportion of those who compose it seem to be loafers, and emigrants of the wrong sort. They give some interesting details of attempts which are being made, especially in New Zealand, both by Government and by private persons, to establish agricultural villages. These seem to offer considerable inducements to settlers having a capital of £50 to £500, though they also offer facilities even for labourers without capital. But in Australia the jealousy of the labouring class, especially perhaps in Victoria, putting pressure on their Governments, would, the writers think, prevent the establishment on any considerable scale, even of such settlements. We commend the pamphlet to all who are interested in the subject.

A Dictionary of Christian Biography, Literature, Sects, and Doctrines, during the first Eight Centuries. Edited by WILLIAM SMITH, D.C.L., LL.D., and HENRY WACE, D.D. Volume IV. London: John Murray, 1887.

The publication of this volume of 1227 double-column pages completes the splendid pile of the fifteen volumes of dictionaries of knowledge down to Charlemagne, which, in this department of literature, we must pronounce to be the crown of scholarship in the United Kingdom. There is no foreign, not even any German, cyclopædia which can be compared with them, either in

fulness and ripeness of scholarship for the period treated, or in literary style and practical usefulness. The scholar and the general reader alike consult them with pleasure as well as profit. They form as complete an Onomasticon down to the eighth century of the Christian era as the most exacting can desire. So far as ecclesiastical history and detailed biography are concerned, Scotland and Ireland are perhaps more fully treated than England, for these were the lands of the saints and missionaries who converted Roman and Saxon England before Augustine of Canterbury.

The geographical value of the Dictionaries is of a high order, wherever, as for instance in the case of Patrick, important questions and controversies centre around rival places. But for our readers the special value of the series centres in the *Dictionary of Greek and Roman Geography*, the second volume of which appeared just thirty years ago. That work has wonderfully maintained its supremacy in spite of advancing scholarship. The contributions to it of such an expert as Mr. E. Bunbury, have given it a unique excellence. We congratulate Dr. William Smith and Mr. John Murray on being spared to complete the enterprise which they began by the publication of the first of these fifteen volumes in 1851.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

SESSION 1886-87.

THE COUNCIL has the honour to submit the following Annual Report :—

The third Session of the Society has been marked by the recognition of its labours by Her Majesty the Queen, who has been graciously pleased to accede to the request of the Society to add the prefix "Royal" to its former designation. Her Majesty's pleasure was intimated to the Society by the President, the Right Honourable the Earl of Rosebery, in the following communication :—

" LANSDOWNE HOUSE, BERKELEY SQUARE,
" 25th June 1887.

" DEAR SIR,—I have the pleasure to enclose herewith a letter which I have received from Lord Lothian, as Secretary for Scotland, intimating that her Majesty has been graciously pleased to accede to the request of the Scottish Geographical Society to bear the designation 'Royal.' Her Majesty's gracious permission will, I am sure, be most gratifying to every member of the Society, since it marks in the most unmistakable way the position which our Society has earned for itself.—Believe me, yours faithfully,

" (Signed) ROSEBERY.

" A. Silva White, Esq., *Secretary.*"

The letter of Lord Lothian, referred to in the above, ran as follows :—

" DOVER HOUSE, WHITEHALL,
23rd June 1887.

S. 1883

" MY LORD,—I have the honour to inform your Lordship, with reference to your letter of the 11th ultimo, that the application of the Scottish Geographical Society to be permitted to bear the designation 'Royal,' has been laid before the Queen by the Secretary of State for the Home Department, and that Her Majesty has been graciously pleased to accede to their request, and to command

that the Society shall in future be styled 'The Royal Scottish Geographical Society.'—I have the honour to be, my Lord, your Lordship's obedient Servant,

"(Signed) **LOTHIAN.**"

"The Right Honourable the Earl of Rosebery, etc., etc., etc."

The Council has resolved to recommend to the Society the granting of Fellowship Diplomas to Ordinary Members and others, on certain conditions, to be submitted at the next Annual Business Meeting of the Society.

MEMBERSHIP.

The following is a Statement of the Membership of the Society, as at 31st October 1887 :—

District.	Membership.
Edinburgh, ...	611
Glasgow, ...	247
Dundee, ...	94
Aberdeen, ...	66
England, Ireland, India, British Colonies, and Foreign } Countries, ...	103
	1121
Deduct names entered in more than one District, . . .	19
	1102
Net Membership, ...	1102

Of the above, 95 are Life Members.

The following shows the increase in the Society's Membership during the Session, and the losses by deaths and resignations :—

Membership—Last year's Report, ...	1088
Less names entered in two Districts ; omitted to } be deducted, ...	19
	1069
Correct net Membership last year, ...	1069
Members elected during Session, ...	129
	1198
Resignations and deletions, ...	82
Deaths, ...	14
	96
	1102
	1102

The net increase in the Membership during the Session was, therefore, 33.

Baron von Richthofen and Dr. Heinrich Kiepert were elected Honorary Members of the Society.

The Honorary Corresponding Members of the Society now number 37, the majority of whom have contributed communications to the Society's Magazine.

The Council is indebted to the Conveners, Secretaries and Members of the Local Committees in Glasgow, Dundee and Aberdeen for the services they have rendered in promoting the interests of the Branches.

FINANCE

The Council submits the following Financial Statement :—

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

For the Year ending 31st October 1887.

Funds at the close of last Account:—

£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,	£1102 19 9
<i>Deduct:</i> Balance due to the Bank of Scotland at Edinburgh, £248, 13s. 2d.; less due by the Bank at Glasgow, £96, 19s. 6d.,	£152 13 8
<i>Less:</i> In the hands of the Secretary, £9 7 2	
Due to the Hon. Treasurer, . . . 1 3 11	
8 3 3	144 10 5
	<u>£958 9 4</u>

ORDINARY SUBSCRIPTIONS:—

12 Life Members, at £10, 10s.,	£120 0 0
Do. £31, 10s., less £8, 6s. 0d.	
1 paid prior years, £10, 10s.,	25 4 0
Do. £1, 1s. 0d.	
1 paid last year, . . .	9 9 0
1 Annual Subscription of £1, 1s., year 1884-85,	1 1 0
Do. 1885-86,	15 15 0
Do. 1886-87,	964 19 0
919	
	<u>1142 8 0</u>

SUBSCRIPTIONS towards the Society's Scheme for the encouragement of Geographical Education,

SPECIAL SUBSCRIPTION paying expenses of Nyassa Meeting.	5 15 0
PROCEEDS OF LECTURES in Edinburgh, Dundee, Aberdeen, and Glasgow,	5 14 9
PROCEEDS OF MAGAZINES sold,	42 1 0
DIVIDENDS and Bank Interest,	17 19 2
	<u>40 2 8</u>

£2212 9 11

Magazine Printing, Paper, Lithographing, etc., and Postage for 12 Numbers, 8 to 12 Vol. II., and 1 to 7 Vol. III.,
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Edinburgh, 12th November 1887. — I have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1887, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

(Signed) JAS. M. MACANDREW, C.A.

MEETINGS OF THE SOCIETY.

The Society has held 19 meetings during the Session—10 in Edinburgh, 5 in Glasgow, 2 in Dundee, and 2 in Aberdeen.

The papers read at these meetings were contributed by:—Sir Charles Warren, who delivered the Anniversary Address; the Rev. James Chalmers, Dr. Robert W. Felkin, Prince Krapotkin, Colonel Sir Francis de Winton, Mr. J. Y. Buchanan, the Rev. Horace Waller, Mr. John Mackenzie, Mr. Russell Robertson, Dr. Wilhelm Junker; and a paper by Emin Pasha, communicated by Dr. Felkin.

The Anniversary Meeting of the Society in Edinburgh was held in the Museum of Science and Art, under the Presidentship of the Earl of Wemyss and March. On the conclusion of the Anniversary Address, a *conversazione* was held in the Museum.

EDUCATIONAL SCHEME.

Arrangements have been made by the Education Committee, under the sanction of the Council, for holding an Examination in January 1888, on “Geographical Terms and the Interpretation of Maps,” in accordance with a Syllabus prepared by the Committee. The examination will be open to all pupils of elementary and secondary schools in Scotland.

A sufficient number of books and atlases suitable for prizes have been obtained from (or promised by) the following firms:—Messrs. W. & A. K. Johnston, Messrs. A. & C. Black, Messrs. Thomas Nelson & Sons, Messrs. Blackie & Co., and Mr. John Bartholomew.

Professor James Geikie and Principal Grant Ogilvie have consented to act as the Society’s examiners.

PUBLICATIONS.

The Society has continued to publish, monthly, *The Scottish Geographical Magazine*. In approving of the manner in which the *Magazine* has been conducted by the Editors, the Council desires to express its recognition of the services rendered by those who have contributed original articles, and also of the valuable aid accorded to the Editors by the following gentlemen:—

Mr. J. T. Bealby, Mr. J. G. Bartholomew, Mr. W. B. Blaikie, Mr. H. M. Cadell, Mr. Scott Dalglish, Dr. Dods, Professor James Geikie, Mr. John Geddie, Mr. John Gunn, Mr. J. W. M’Crimdall, Dr. Hugh R. Mill, Mr. Ralph Richardson, and Dr. George Smith.

The Council regrets that Mr. Hugh A. Webster, shortly after his appointment to the Librarianship of the University of Edinburgh, tendered his resignation as Honorary Editor of the *Magazine*, in consequence of insufficient leisure to perform the duties required of him; and they desire to record their thanks to Mr. Webster for the valuable assistance rendered by him during the period of his office. In the early part of the Session, the Council appointed as Assistant Editor Mr. J. T. Bealby, who, besides contributing articles and reviews, has taken the compilation of the *Geographical Notes* almost exclusively under his care. Pending new arrangements, Mr. Coutts Trotter has kindly consented to discharge the duties of Honorary Editor.

LIBRARY AND MAP DEPARTMENTS.

The Library and Map Departments have continued to receive numerous and valuable accessions. For the Session of 1886-7 these comprised 335 books, 135

maps, charts, and atlases, and a large number of periodicals. The Library now contains 4717 items.

The Society's Exchange List includes at present the names of 102 Societies and Public Institutions. The large number of foreign publications received is an important feature of the Society's resources ; the fresh information constantly coming in from so many regions of the globe forms a continuous record of great value as a means of reference.

The Council gratefully acknowledges the receipt of the following Government publications :—

From the Government of Italy.—*Reports on Statistics of Parish and Provincial Finance ; Emigration ; Periodical Press ; Civil, Commercial, and Criminal Judiciary ; Elementary, Secondary, and Superior Instruction ; Industry of various Provinces ; Political Electorate ; Charitable Institutions ; Movement of Periodicals, Population, Invalids in Civil Hospitals ; Prices of Food ; Acts of Commissions for Re-arranging Civil and Criminal Judiciary Statistics, and for Revision of the Tariff ; History of the Periodical Press ; Study of the Population for the Century in Italy and other States ; Hygienic and Sanitary Condition of Parishes ; Customs and Commercial Legislation and Statistics ; Statistical Year-Book, 1886, etc.*

From the Government of Norway.—*Official Statistics of Norway ; Journal of the Central Bureau of Statistics ; Observations at the Norwegian Polar Station of Bossekop in Allen ; Memoirs of the Norwegian North-Atlantic Expedition, 1876-78 (through Professor Mohn, Christiania).*

From the Government of India.—*Reports, Memoirs, and Records of the Meteorological Department ; The Geological Survey ; The Archaeological Survey ; The Marine Survey ; Administration Reports on Railways ; and Reports on the Administration of the Presidencies and of various Provinces, including British Burma.*

From the Government of the Cape of Good Hope.—*Civil Service List, 1887 ; Statistical Register, 1886 ; Report of Meteorological Commission, 1886 ; Agent-General for Cape of Good Hope—Official Handbook, 1886.*

From the Government of Canada.—(Minister of the Interior, Ottawa)—*Report of the Hudson's Bay Expedition of 1886 ; Charts of Temperatures of Hudson's Bay Region and Eastern Canada, 1885-6. Geological and Natural History Survey—Descriptive Catalogue of the Economic Minerals of Canada, Annual Report, 1885.*

From the United States Government.—*Reports of Tenth Census ; Mortality and Vital Statistics ; Mining Industries ; Education in Alaska ; Bulletins, Monographs, and Reports of Geological Survey.*

From the Consul of Venezuela, London.—*Correspondence between the Venezuelan and British Governments on the Question of the Frontier, 1887.*

From the Government of Victoria.—*Reports of Secretary for Mines and Mining Registrars.*

The Council also gratefully acknowledges a large number of Donations from private sources.

Among private Donors may be mentioned—Messrs. T. and A. Constable ; Dr. R. N. Cust ; C. W. Eves, Esq. ; John G. Gamble, Esq. ; Professor Carl Hansen ; Herr Emil Metzger ; George Riddell, Esq. ; Dr. George Smith ; S. Wm. Silver, Esq.

EXPLORATION.

The Society has let pass no opportunity to promote the advancement of Geographical Exploration and Research. It was actively engaged during the Session in bringing before Her Majesty's Government and the public the pressing need of an expedition being sent for the relief of Emin Pasha and his beleaguered garrisons in the Egyptian Equatorial Provinces. It was hoped that any well-equipped expedition, in penetrating to and returning from these remote parts of Africa, could not fail to perform useful exploratory work by the way. Her Majesty's Government, though unwilling to undertake the equipment of the expedition, handed over for this purpose the special grant made by the Egyptian Government to a syndicate of private gentlemen, among whom were several members of the Society's Council. To Mr. William Mackinnon, of Balinakill, one of the Vice-Presidents of the Society, was intrusted the task of despatching the expedition. Mr. Mackinnon's efforts were so well directed that in a short space of time the Expedition was organised and placed under the command of Mr. H. M. Stanley, whose reports since his departure on 21st January last show a satisfactory advance in the direction of his goal.

Mr. Henry O. Forbes, towards whose expedition to New Guinea the Society had raised the sum of £500, reported to the Society last June that, although he had not succeeded in reaching the summit of the Owen Stanley range, he felt satisfied with the work he had been able to accomplish. He had made a triangulated survey of the district traversed; he had collected a large mass of meteorological data; he had obtained an interesting ornithological collection; and he had put together by far the largest herbarium yet brought out of New Guinea. He will use all the time at his disposal in preparing a report of the results of his expedition.

As regards the promotion of Antarctic exploration, in which the Society was interested, the Council regrets to say that no satisfactory advance has been made in this country towards equipping and sending out an expedition.

For the Council,

ARTHUR SILVA WHITE, F.R.S.E.,
Secretary.

EDINBURGH, 14th November 1887.



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ERRATA.

On page [479](#), under "Kingdom of Hanover," read "annexed" for "re-united."
 „ „ [605](#) read "[19,680](#) feet" as the estimated height of Mount Kilima-njaro.

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